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## ERRATA

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*On page 493, 4th line from above* 'On Saturday, 3rd March, at about 4 p.m. on Malad-Merve beach near Bombay, at 2-20 p.m., *substitute* 'On January 16th one chick emerged at 9-15 a.m. and a second at 2-20 p.m. These'

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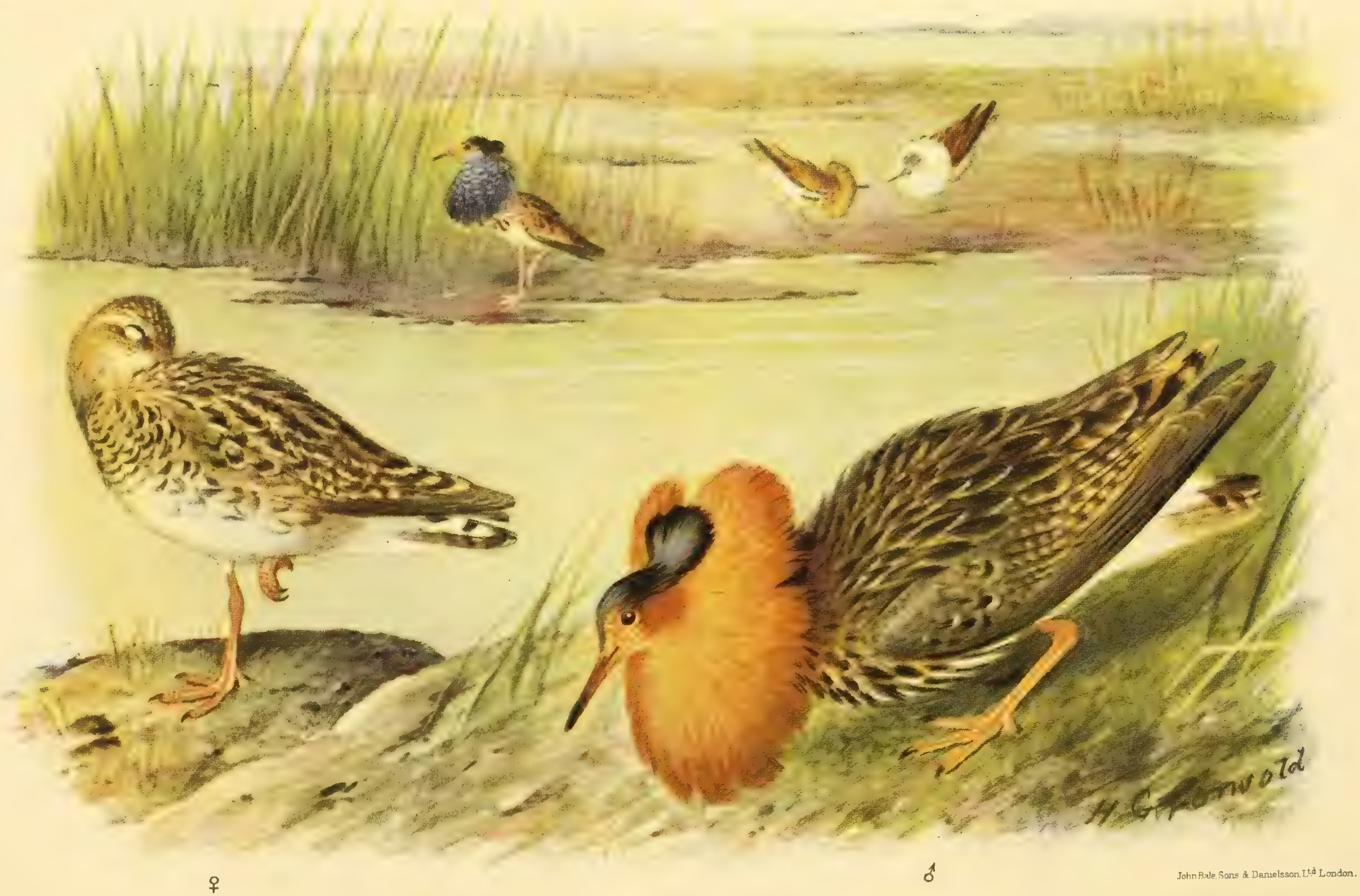

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THE RUFF AND REEVE. 1/3
*Philomachus pugnax.*

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## THE GAME BIRDS OF THE INDIAN EMPIRE.

BY

E. C. STUART BAKER, C.I.E., F.Z.S., F.L.S., M.B.O.U., H.F.A.O.U.

### VOL. V.

### THE WADERS AND OTHER SEMI-SPORTING BIRDS.

### PART XX.

(*With a coloured plate*).

(*Continued from page* 306, *of Volume* xxxvi).

### GENUS: PHILOMACHUS.

*Philomachus*—Anon., Allg. Lit. Zeit, 1804, Col. 54.

Type by mon.—*Tringa pugnax* Linne.

This genus is distinguished from other genera of the family in having the male much larger than the female, whilst the former in the breeding season assumes a ruff of long feathers extending from the nape down each side of the neck and varying in colour to the most extraordinary degree. The Ruff is said to be polygamous and to fight and display for the females in a manner very like some of the Game-birds.

The bill is moderately long, straight and flexible, both mandibles grooved over the greater part of their length, the linear nostril being placed in the groove close to the base of the upper mandible; the wing is of the usual shape, long and pointed with the first primary longest; the inner secondaries are lengthened; tail rather short and rounded; the tarsus is longer than the bill from the gape and transversely shielded in front and behind; hind toe moderate, outer and middle toe connected by a web, that between the inner and middle toe obsolete; the tail-coverts are very long.

There is but one species which extends throughout Europe and Asia.

### PHILOMACHUS PUGNAX.

### *The Ruff and Reeve.*

*Tringa pugnax.*—Linn., Syst. Nat., 10th ed., i, p. 148 (1758) (Sweden).

*Pavoncella pugnax.*—Blanf. & Oates, iv, p. 268.

*Philomachus pugnax.*—Fauna B.I., Birds, 2nd. ed., vol. vi, p. 228.

*Vernacular names.*—Geh-wala (Hind.).

*Description—Winter plumage.*—Forehead, feathers round the eye, cheeks and chin whitish, more or less suffused with buff; lores speckled brown and buff; upper parts brown, the feathers of the crown, scapulars and inner secondaries with visible dark brown centres and bands, concealed on the hind neck and upper back; tail brown with pale edges to the tip; wing-coverts like the back; the greater with broad white edges, primary coverts black with white edges; primaries brownish-black with white shafts; outer secondaries brown with white edges and tips; lower plumage and axillaries white, the throat, fore-neck and breast suffused with brown or buff.

*Colours of soft parts.*—Iris brown; bill dark brown, more yellow and paler at the base; legs and feet fleshy-yellow to horny-brown in adults; grey, olive-grey or plumbeous in the young.

*Measurements.*—Wing, ♂ 173 to 190 mm., ♀ 150 to 166 mm.; tail, ♂ 78 to 89 mm., ♀ 64 to 70 mm.; tarsus, ♂ 46 to 50 mm., ♀ 41 to 44 mm.; culmen, ♂ 30 to 36 mm., ♀ 29 to 31 mm.

*In Summer* both sexes have the upper parts blackish, the feathers edged with buff or rufous, whilst the breast, flanks etc. are much more suffused with brown.

The male at this season has the face covered with yellow carbuncles and grows an enormous ruff which extends from the nape to cover the entire breast. This ruff may be of any colour, chestnut, buff, white, black or grey; sometimes it is immaculate but most often it is closely barred or streaked with blackish; whatever may be the dominating colour of the ruff, it extends to the mantle and scapulars and, less often, to the inner secondaries as well as to the sides of the breast and flanks.

*Young birds* resemble the female in Summer but are duller and less barred and marked with blackish; the underparts are more strongly sullied with brownish-isabelline.

*Distribution.*—Ruffs and Reeves are found over the whole of Northern Europe and Asia, breeding as far South as Denmark and Holland—in former days in England—also in Esthonia and Central Russia. Its limits south during the breeding season in Siberia have not been defined. In Winter it occurs in Africa and Southern Asia. Within our own limits it has been found in the extreme north and the extreme south and in Ceylon. By preference the Ruff is a bird of coastal marshes and therefore its occurrences inland are not very numerous but there are not many places in India where it has not been met with, provided there is suitable country.

*Nidification.*—There are few birds whose nidification and domestic arrangements are more interesting than those of the Ruff and the Reeve. For breeding purposes they undoubtedly prefer wide expanses of marshlands not very far from the sea or on the shores of great lakes, such as occur in vast numbers in Finland and Lapland. When the breeding season commences the Ruffs and Reeves are still in combined flocks and the two sexes continue together until egg laying has actually begun. In the southern portions of their breeding range nesting commences in May and I have even heard of eggs laid in the last week of April. As one works further North nesting operations do not commence until the middle or end of May, whilst in the far North few eggs are laid before June. After the eggs are laid the Ruffs keep together in parties but the Reeves no longer consort together. Both before and after breeding commences Ruffs indulge in very wonderful displays and in much mock fighting. These displays may be carried out on any small piece of ground rising above the surrounding marsh, but even when the site is selected on an expanse of fairly dry land, the dancing nearly always takes place on the highest portion of it. Attendance at these showing-off places does not seem to be carried out according to any particular rule. Flights of three or four Ruffs arrive on the empty ground and after perhaps casually pecking round for a short time, suddenly start dancing. Sometimes a Ruff will run a few paces forward entirely by himself, then stop, spread his ruff and begin prancing about. At other times two birds will perform the same manoeuvres, eventually facing one another, where they stand, ruffs widely distended and heads held close to the ground. After a second or two in this position, each bird will jump into the air and pretend to tackle the other but I have never seen fighting take place in earnest. After a few minutes, the first flock may be joined by a second and so on for some hours; birds come and go, by no means always leaving with the same flock as that with which they arrived. When spending my holidays in Lapland I have sometimes stayed at a small farmhouse from which I was able to watch the Ruff's dancing-ground not thirty yards away from my window. So long as one kept quiet the birds seemed to be oblivious to one's presence, whether standing inside or outside the house, and they seemed to be equally little affected by the weather, for I have seen them performing all their evolutions with the same zest during driving snow and bitter east wind and in the midnight sun that shone warm and comforting. I have spent many a pleasant hour watching the birds from the above farmhouse and my watching has made me wonder whether the reputation acquired by the Ruffs for being polygamous and by the Reeves for being polyandrous is really deserved. In the first place the showing-off and so-called fighting among the Ruffs took place quite independently of whether any Reeves were present or not, nor did the fighting increase in bitterness when a Reeve, or Reeves, appeared on the scene. If two males were engaged in a *pas a deux*, perhaps one would stop and go and join the Reeve, when the other would continue his posturing and take absolutely no interest whatsoever in the departing Ruff and his mate. Again, I have sometimes, especially during the very early hours of the morning—between one and four o'clock—watched a Ruff and a Reeve continue in company the whole of this time and on one occasion I was within sight of three pairs, each wandering about entirely on its own. I myself came to the conclusion that the Ruffs, who took extraordinarily little interest in nest, eggs, or young, amused themselves at their 'clubs' while their wives carried on their domestic duties and, if one of the latter wished to interview her husband, she merely sought him out at one of his 'clubs', where he promptly joined her without any unpleasant remarks being made by his clubmates.

The extraordinary variation in the plumage of the Ruffs fortunately makes the identification of individual birds a very easy matter, and day after day we would see the same little group or groups of birds perform in exactly the same spot or spots. The opinion I formed after many visits to Lapland and much careful watching of the birds, was that Ruffs and Reeves pair just like other birds and, however neglectful a husband, the Ruff, may be, neither he nor his wife deserve the reputation they now possess.

Reeves breed in practically any kind of marshland and sometimes in almost dry pasture or sandy grassland. I have found their nests in the middle of extensive swamps, knee-deep almost everywhere in mud, with intervening spaces of much greater depth. I have taken others in places where one might wander miles without getting into mud over one's ankles and I have also occasionally taken them on the breeding grounds of Temminck's Stint, stretches of perfectly dry ground with alternating patches of short soft grass and bare gravelly patches. One very favourite swamp in the South of Lapland consists for the most part of black quivering mud of unknown depth, relieved here and there by little patches of rather thicker mud where tussocks of grass enabled one to walk in comparative safety. The one year in which I worked this place and before experience had taught me its danger, we found many nests of the Reeve in these same tussocks of grass, but one year's experience of this particular swamp satisfied all my ambitions and I have since left it undisturbed.

The nest of the Reeve, wherever it may be placed, is nearly always well hidden and, though it is such a common bird and one feels that one *ought* to find nests by the dozen, one's expectations are never realised. Once the eggs are on the point of hatching the hen bird sits very closely but she is so clever that when she does leave the nest, she gives little clue to where that may be. As a rule when one is still 20 or 30 paces away she comes off her eggs and, head and tail held low down, sneaks quietly away through the cover. When she thinks she has got far enough away from it she stands upright and in the most unconcerned way possible begins to peck insects off the grass all round her. As her disturber approaches, she wanders away slowly in front, taking a zigzag course, but one which all the time leads her away from the nest. So anxious, however, is she to get one away that she will frequently allow approach within two or three paces of her and on one occasion I actually dropped my cap over her as she stood in apparent unconcern a couple of yards in front of me.

Eventually we found that the easiest way to find the nest was to place a stick in the ground at the spot where we had first seen her and at the place where we were standing when we first caught sight of her. A beat round between these two spots sometimes revealed the nest. Of course when the birds are sitting close after incubation has begun one may, especially if it is a windy, rainy day, get quite close to them by walking against the wind and rain and I have sometimes found two or three nests in a morning in this way. The birds do not always, or even generally I think, make their nests close to where the cock birds have their dance grounds. I remember one stretch of swamp where there were three or four such places, and General Betham, a Swedish friend, and I worked the whole area out most carefully but we only found five Reeves' nests in the course of three days' search, although there were at least fifty Ruffs showing off on the various mounds and at least fifty Reeves visiting the place from time to time. Indeed we noticed here that very often after the Reeves had been to one of the 'clubs' they would fly away entirely out of sight, obviously to some other swamp a good distance off. Nor do all the Reeves, as has often been suggested, of any one particular area, breed in company and I have never found more than three, or at the utmost four, nests in close proximity to one another.

The nest itself is a very primitive affair, but whether placed in swamp or in dry ground, it is always above the wet and, wherever necessary, sufficiently lined with fine grass or by the surrounding grass being beaten down to keep it snug and warm. The grass over the nest is never arranged in the curious little twist beloved both by the Common and Dusky Redshanks but, at the same time, it is seldom easy to spot. The eggs are normally four in number though three only are occasionally laid. When I wrote the *Fauna of India* I was under the impression that threes and fours were almost equally common but my personal experience of the last few years has shown me that threes are really exceptional, and that four is really normal, just as it is with other waders. As a series the eggs of the Reeve do not vary very much. In nine clutches out of ten, the ground colour is some shade of buffy brown, heavily blotched and spotted, especially at the larger end, with dark brown, or blackish brown and a certain number of secondary blotches of pale lavender or inky grey underlying. As a rule the markings are large, bold and clean cut but in others they are somewhat smudgy. In nearly all eggs the markings are most numerous at the larger end, where they occasionally form a cap but never rings. In some eggs the ground colour is tinged with yellowish and in others it is distinctly greenish. Occasionally a clutch may be met with with a pale grey stone ground. I have one clutch of this latter, heavily marked with deep blackish brown and with numerous secondary marks in addition, which but for their size, are exactly like the eggs of the Greenshank. Occasionally also eggs may be found which are very hard to distinguish from those of the Great Snipe. In shape the eggs are generally rather broad ovals and distinctly pointed at the smaller end. Other eggs are somewhat longer ovals in shape while occasionally one meets with very short stumpy ovals.

Jourdain gives the average of 141 eggs as 43.9 × 30.7 mm.; maxima *47.5* mm. × 30.5 mm. and 43.2 mm. × *32.1* mm.; minima *39.8* mm. × 31.6 mm. and 42.9 mm. × *28.0* mm.

*Habits.*—Ruffs and Reeves, all in winter dress, arrive in India in some numbers during September and are in full force by the middle of October, whilst a few small flocks arrive in the North of India, especially in the North-West, in the end of August. They leave us again for their breeding haunts in April, by which time a few of the males are beginning to assume summer plumage. Ticehurst remarks that he has never seen or heard of a bird being obtained in India with a ruff, but such birds have been shot on several occasions. Messrs. Mundy and Moore say they once shot Ruffs in the Dibrugarh district which were beginning to assume the ruff and I myself obtained one such specimen on the 2nd of May, an individual out of a small flock of about a dozen birds on their migration to the North. The individual shot was the only one in the flock which had begun to acquire the ruff. As a rule the males before they leave us have acquired a certain amount of brown on the breast and flanks as well as the blackish upper parts. It is curious that birds seem to stay later in India in the North-East than they do in the North-West, for Ticehurst says that the latest date he has seen them in Sind is the 2nd of April, whereas, as already noted, in Assam I have seen birds exactly one month later than this and have frequently seen others in the middle and third week of April.

Ruffs and Reeves are very gregarious birds and one seldom sees flocks of less than half a dozen or a dozen, though nearly all the other waders may be met with singly or in pairs. Sometimes one sees in winter small flocks consisting entirely of males or females but as a rule the two sexes are found together in about the same numbers. Sometimes the flocks are very large and on one occasion I saw one which must have numbered at least 200 and possibly a great many more. In their winter haunts they are not at all wild and generally allow a fairly close approach, though flocks coming into India or leaving it seem to be much wilder than those which have settled down. With us they seem to prefer the bigger swamps and marshes, especially those which are on or near the coast, but I have seen them on sandbanks in and beside rivers and, stranger still, once or twice on the shingly shores of streams debouching from the Himalayas; probably in the latter cases the birds were merely resting on migration to and from India.

Like most of the waders and indeed with like most other migratory birds as well, the Ruffs and Reeves when entering North-East India seem to fly from one great mountain ridge to another rather than, as is so generally supposed, following the course of some great river. I have twice noted seeing Ruffs and Reeves on grasslands of the Barail Range at about 4,000 feet. On both occasions the birds merely pitched into the grass for a very short period and then passed on South. When shooting on the North bank of the Brahmapootra we of course often saw these birds in the swamps but when we worked up rivers such as the Subansiri, Dibong, or Dihong, well into the hills, we never met with them.

Ruffs and Reeves have a strong powerful flight, more direct and less wheeling than that of most waders, but at the same time they offer quite sporting shots and, as when shot they provide quite a dainty dish, they are certainly entitled to be ranked as semi-sporting birds. The only call we are likely to hear in India uttered by this bird is a low 'chuck, chuck' as they alight or as they take to wing.

Their food consists of all insects, small mollusca, tiny frogs and reptiles and also of many kinds of berries, seeds, rice and other grain. When they arrive in India they are sometimes, but by no means always, in poor condition, but a very few days serve to fatten them and when shot in December, January and February, they are often regular balls of fat.

## SUB-FAMILY: *Eroliinae.*

In this sub-family are contained those genera in which the anterior toes are divided to the base. In one genus there is no hind toe but in the others this is well developed. The wing is shaped as in the *Tringinae*, with the first primary the longest; the bill is slender, flexible and either quite straight or slightly bending downwards; the tail is moderate and almost square, some species having the median rectrices slightly acuminated and projecting beyond the others, for which they, in consequence, have been placed in a separate genus by some authors.

A. No hind toe ... *Crocethia*, p. 231.
B. A hind toe
  a. Bill spoon-shaped, greatly expanded at the tip ... *Eurynorhynchus*, p. 232.
  b. Bill slender, not spoon-shaped ... *Erolia*, p. 233

## GENUS: CROCETHIA.

*Crocethia Billberg.*—Synops., Faun. Scand., i (2), tab. A, p. 132 (1828).

Type by mon.—*Tringa alba* Vroeg.

This genus, which contains but one species, the Sanderling, is very close to *Erolia* but is separated from that genus by possessing a hind toe; the bill and tarsus are about equal in length.

## CROCETHIA ALBA.

### *The Sanderling.*

*Trynga alba* Pallas, Vroeg's Cat. Coll. Adum., p. 7 (1764, (Holland).

*Calidris arenaria* Blanf. & Oates, iv. p. 279.

*Crocethia alba*, Fauna of British India, Birds, 2nd. ed., vol. vi., p. 231.

*Vernacular names.*—None recorded.

*Description.—Breeding plumage.*—Upper parts rufous, each feather with a broad black centre and narrow white fringes; lateral rump-feathers and upper tail-coverts white; primaries black with white shafts and with pale inner webs becoming white, this extending to the outer webs on the innermost primaries; outer secondaries grey with white edges; greater coverts brown with broad white tips; inner coverts like the back; chin, throat, foreneck and upper breast rufous, spotted with black; remaining under plumage, axillaries and under wing-coverts white, the rufous with black spots sometimes extending down the flanks.

*Colours of soft parts.*—Iris dark brown; bill black; legs and feet dusky-grey or brown to black.

*Measurements.*—Wing 118 to 129 mm.; tail 52 to 62 mm.; tarsus 23 to 26 mm. (once 21 mm. only); culmen about 21 to 26 mm., once 28 mm.

*In Winter* the upper plumage is black with broad white edges, giving the impression of greyness; the hind-neck is generally grey, the dark centres obsolete; forehead and face white, but generally some rufous and black markings on the lores; lower back, rump and upper tail-coverts grey, the back and rump with tiny black bars, the coverts with pale whitish tips and blackish sub-tips merging into the grey of the base; wing-coverts and inner-most secondaries like the back; quills as in the Summer plumage; lower plumage all white.

*Nestling.*—Upper parts stippled with light and dark buff and black with tiny specks of white; forehead buff with a black line from the base of the upper mandible to the crown, two black lines above and below the lores to the eye. Under-parts white, cheeks, chin and throat tinged with buff.

*Distribution.*—The Sanderling is one of the most northern of our waders during the breeding season, being found in Spitzbergen and the extreme North of Russia and Siberia. It also extends to Greenland and Alaska and has been reported—probably by mistake—as breeding in Iceland. In Winter it is practically circumpolar being found in Africa, practically the whole of Southern Asia, Australia, Chile and Patagonia. In India it is a common bird down the West Coast as far as Malabar but on the East Coast and in Eastern India generally it is much less common, although every winter a certain number do occur. In Assam and Eastern Bengal I came across it yearly but never in any very great numbers.

*Nidification.*—The Sanderling is still one of the birds about whose nidification very little is really known. It has been found breeding in Spitzbergen, Taimyr, New Siberian Islands, Melville Islands, and Ellesmere Land and Greenland and again in Alaska. The bird is said generally to select rather barren stony places for breeding purposes though the nest itself is generally made where there is a little grass. It consists merely of a few blades of grass in a natural hollow, occasionally surrounding grass being bent down to make it rather more substantial. As might be expected in a bird breeding so far North, the season is very late, few birds commencing to lay before the end of June, while more lay about the middle of July. The number of eggs laid is of course four as with all waders. In Witherby's *Practical Handbook* Jourdain describes the eggs as follows:—

'Ground colour pale greenish when fresh, fading to buffish or ochreous, and sparsely marked with small brown spots and ashy shell-marks, with occasionally a blackish streak or a spot or two at the larger end.'

Average of 41 eggs:—35.7 x 24.7 mm.; maxima *38.2* x 24.7 mm. and 34.1 x *26.1* mm.; minima *33.1* x 24.4 mm. and 35.3 x *23.5* mm.

Both Fielden and Walter shot male birds off the nest, so there is no doubt that both sexes participate in the duties of incubation. During the breeding season they are said to be fairly tame and to allow of a close approach when sitting. Dr. Hortling and I saw this bird in full breeding plumage at Pumanki in the extreme North of Lapland on the 20th of June, but this is very far South of their usual breeding habitats, though nestlings were seen once on Bear Island.

*Habits.*—In India the Sanderling is comparatively common as a winter visitor but is much more numerous on the West than on the Eastern side. In the extreme South it has twice been obtained in Ceylon, but is extremely rare even so far South as Travancore. In its habits generally it differs very little from those other small waders that visit India but I do not think it is ever found in separate flocks. As a rule single birds or pairs are seen feeding on marsh lands or mud flats in company with other small waders and as these may happen to be wild or tame so will appear to be the Sanderling that are with them.

Their flight is exactly like that of the Green Sandpiper or Dunlin and is very fast but at the same time I do not think the Sanderling is one of the small birds which one could call semi-sporting. Its food consists of all kinds of small insects, tiny worms, mollusca and also seeds and certain water plants. In Europe it feeds largely on small crustacea and, according to Witherby, on bits of moss and algæ.

The Sanderling arrives in India the same time as our other small visitors. A few birds of the Western coast arrive in August but the majority not until late September, while on the Eastern side of India I do not remember ever seeing them before the end of that month.

Ticehurst has an interesting little paragraph on this bird in the *Ibis* of 1924, p. 118, where he writes:—

'Amongst the host of small waders which frequent the broad foreshore at low-water, the Sanderling can be recognized as far off as it can be seen by its ceaseless activity: it is running quickly, all the time incessantly picking at what it is searching for, leaving all other waders "standing". I fancy its food consists of small crustaceans brought in by each lap of the waves, but I also identified chrysalids of Diptera washed out of wrack. When the tide comes up to the full of the beach (here sand), all waders stop feeding and congregate in large flocks above high-water mark to await the tide's ebb, but the Sanderling feeds on after all the others, and only joins them for a brief space at dead high-water. It is remarkable how quick is digestion in waders: birds shot at high-water during the rest-period, which only extends over about an hour, have their stomachs already empty.'

## GENUS: EROLIA.

*Erolia* Vieill., Anal. nouv. Orn., p. 55 (1816).

Type by mon.—*Erolia variegata* = *E. ferruginea* Brunnich.

In this genus the bill is flexible and slender, varying a good deal in length and either straight or slightly curving downwards; both mandibles are grooved and the small nostril is placed near the base; the tarsus is short and scutellated: there is a hind toe present and the anterior toes have no webs between them; the wing is long and pointed, the first primary longest; the tail is nearly square, with the centre feathers pointed and projecting beyond the others.

In the present work I retain in the genus *Erolia* all the species accepted by Blanford as belonging to *Tringa*, with the exception of the Knots, which are now generally accepted as belonging to a different genus, *Calidris* and the Broad-billed Stint, *Limicola*, by itself, a division which is also now universally accepted. This leaves seven species occurring within the limits of this work, whilst the genus, as a whole, may be said to be cosmopolitan.

### EROLIA MINUTA MINUTA.

### *The Little Stint.*

*Tringa minuta* Leisler, Nacht. Bechst. Nat. Deutsch., p. 74 (1812) (Hanau); Blanf. & Oates, iv, p. 273.

*Erolia minuta minuta.*—Fauna of British India, Birds, 2nd. ed., vol. vi, p. 234.

*Vernacular names.*—*Chota Pan-loha* (Hind.).

*Description.*—Breeding plumage. Forehead and small supercilium, often obsolete, pale fawn; crown and mantle blackish, each feather with rufous edges to the sides and those of the mantle with white fringes; hind-neck paler and less broadly marked with black; lower back, rump, upper tail-coverts and central tail-feathers blackish with paler edges; sides of rump and lateral upper tail-coverts white; lateral tail-feathers pale grey-brown with whitish edges; wing-coverts grey-brown with darker centres and the greater with broad white tips; quills blackish with white shafts; the inner webs of the primaries and outermost secondaries paler and the central secondaries dark grey with white edges; under-plumage white, the breast suffused with rufous and speckled with black.

*Colours of soft parts.*—Iris brown; bill black; legs and feet olive-plumbeous or blackish-brown.

*Measurements.*—Wing 91 to 98 mm.; tail 38 to 43 mm.; tarsus about 20 to 21 mm.; culmen 17 to 19 mm.

*In Winter* the upper parts are grey-brown, the crown with broad black streaks, the hind-neck only faintly marked, the mantle with black shaft-streaks and the scapulars and secondaries edged with white; the greater coverts are grey-brown with broad white tips forming a wing-band; below the whole plumage is white, the breast sometimes faintly marked with brownish.

*Young birds* are like the adult in Summer with the whole under-parts white or nearly so, the hind-neck is more grey, less rufous, whilst the rufous on the mantle is less dominant.

*Nestling.*—Upper parts rufous, mottled with black, the nape more ochraceous-buff and the crown dark buff; a black median coronal line and a second black line from the lores through the eye; sides of the head, chin, throat and breast ochraceous, remaining under-parts white.

*Distribution.*—Northern Europe to Central Siberia, migrating South in Winter to Northern Africa, Palestine, Arabia, Mesopotamia, North-West and Western India to Ceylon; East it is more rare but extends to Bengal, Assam and Madras.

*Nidification.*—The Little Stint breeds from Northern Russia to Central North Siberia and regularly, but in small numbers, as far West as Finnish Lapland, where a nest has been occasionally taken by Finnish naturalists, and where I personally saw pairs during the breeding season, though I failed to find the nest. The birds are late breeders; over the greater part of their range they probably commence breeding about the 20th of June but at Kolguev Pearson found fresh eggs on July 14th, taking numerous nests during the greater part of that month and again equally numerous nests at Novya Zembla from the last week in June to the third week in July. Preferably the Little Stint breeds on marshes close to the sea and frequently on islands in it, but at the same time Pearson often found the nests on marshes far inland, and he also found them breeding in thick green moss in wet ground on the uplands. The nest is a very simple little affair, merely a small amount of grass twisted round and placed in hollows among dry grass in the marshes or, as already stated, in thick soft green moss on the highlands. The nest is generally fairly well concealed but the little bird sits so close that the nests are very easy to find, for she never leaves it until almost trodden on and even then remains in its immediate vicinity. Again and again Pearson remarks on the extraordinary tameness of this little wader. Frequently when the eggs were taken and Pearson and his brother sat down by the nest, the little bird would return and sit by it, within a few inches of them, looking up in their faces as if beseeching them to return the eggs, while at other times she would 'execute a little dance within a few inches of their feet'. Apparently the depressions in which the nests are placed are natural ones among the grass roots and not excavated by the birds themselves, while at other times the nest merely rests lightly at the bottom of a tuft.

A complete clutch of eggs is invariably four in number and they are in appearance typical little waders' eggs. The ground colour varies from pale grey, yellowish grey or stone colour, to a pale buff, while still more rarely it may be a pale blue green. The markings consist of small spots and blotches of various shades of brown and red brown, ranging from quite a pale sienna brown to a rich purple or blackish brown. These are distributed fairly numerously over the whole egg but are always more plentiful at the larger end. Under these primary markings are a certain number of lavender and blue grey of the same size, which are distributed in the same manner but are never very prominent. In some eggs the spots are all replaced by larger blotches, such eggs being very handsome.

Jourdain gives the average of 100 eggs as 28.8 × 20.7 mm.; maxima 31.7 × 20.3 mm. and 30.0 × 21.4 mm.; minima 26.7 × 20.0 mm. and 28.7 × 19.6 mm.

In shape the eggs are the usual pegtop or pointed ovals and in texture they are hard, close and fairly fine, sometimes showing a slight but distinct gloss. The male bird does nearly all the incubation but sometimes, at all events, the female also sits on the eggs, for both Pearson and Harvie Brown caught female birds on the nest. Incubation, according to the Finns, takes 16 days.

*Habits.*—This little wader arrives in India early in August, the first few birds turning up in the second week in that month, while the full flood arrives in September. I have noticed that the first few birds to arrive in this country are always females and Ticehurst remarks that the adults of nearly all waders arrive in Sind during the first days of August, while the young of the year do not arrive till three or four weeks later. Ticehurst also reports that in Karachi Harbour the Little Stint arrives with great punctuality during the last days of July. In India it is an inland swamp bird almost to the same extent as it is a bird of swamps near the sea. I have noticed it in immense numbers in Assam and even in Western Bengal but, apparently, in Central India it is a comparatively rare bird. It is generally found either singly, in pairs, or in quite small parties, though it consorts regularly with other waders with which it feeds in company. It is an active restless little bird except during the extreme heat of the day, when they may be seen resting on one leg with their head well tucked in between the shoulders. Their actions when running about and also their flight are very similar to those of other small waders, but the speed with which they rise from the ground, twisting rapidly the first few yards, is very noticeable. Their breeding display is similar to that of Temminck's Stint described further on. Their food consists of small coleoptera, mollusca and insects of all kinds and occasionally seeds and buds of marsh plants.

### EROLIA TEMMINCKII.

### *Temminck's Stint.*

*Tringa temminckii* Leisler, Nacht. Bechst. Nat. Deutsch., p. 63 (1912) (Hanau); Blanf. & Oates, iv, p. 275.

*Erolia temminckii.*—Fauna of British India, Birds, 2nd. ed., vol. vi, p. 237.

*Vernacular names.*—None recorded.

*Description.*—*Breeding plumage.*—Upper plumage black, the feathers of the crown edged with rufous, those of the back etc. barred and tipped with rufous; lower back and rump blackish;

central tail-coverts blackish, finely edged and tipped with rufous and sometimes notched with the same; lateral tail-coverts white; inner wing-coverts and inner secondaries like the back; median coverts brown edged with grey; greater coverts darker brown, broadly edged with white; primary coverts and primaries black, the first primary with a white shaft, the inner primaries with a white patch at the base of the inner webs; outer secondaries brown with white bases and edges; sides of the head and neck fulvous-white streaked with dark brown; chin and throat fulvous-white, very lightly streaked; breast a darker fulvous streaked with black and with indefinite bars on the lower breast and anterior flanks; axillaries and lower plumage white; central tail-feathers brown; outer white.

*Colours of soft parts.*—Iris brown; bill black; legs and feet olive-green or yellowish-olive.

*Measurements.*—Wing 90 to 100 mm.; tail 45 to 48 mm.; tarsus about 16 to 19 mm.; culmen 15 to 17 mm.

*In Winter* the upper plumage is light grey-brown, each feather with paler grey edges and a dark shaft-streak; head and neck paler and more grey, the shaft-streaks obsolete; forehead and supercilium white; sides of the head pale grey; chin and throat white; foreneck, sides of neck and extreme upper breast pale brownish-grey, the centres of the feathers darker; remainder of under-plumage white.

*Nestling* like that of the Little Stint but paler, more yellowish-buff and less cinnamon or rufous.

*Distribution.*—Breeding from Scandinavia to North-East Siberia. In Winter South to North Africa and Southern Asia. In India found all over the North in great numbers, becoming less common in the South and rare in Ceylon. It is common some Winters in Assam and Bengal but much less common in Burma, though it is found as far South as Tenasserim.

*Nidification.*—The nidification of Temminck's Stint is very similar to that of the Little Stint but, although many nests of the latter bird may be found fairly close together, it can hardly be said to breed in colonies, whereas I have found 12 or 15 nests of Temminck's Stint within an area of about half a square mile. Like the Little Stint, they are late breeders and very few nests with their full complement of eggs will be found before the second week in June and far more in the last week of that month. I have found them breeding on islands in the north of the Baltic in great numbers but, in several years, no eggs were laid until the end of June, while even in warm years I found none before the 15th of that month. On the other hand at Pumanki in extreme Northern Lapland the birds all seem to have finished laying —in 1933—before the last week in June, and we found hard-set eggs on the 13th of that month. Undoubtedly Temminck's Stint prefers to breed in great stretches of short grass lands near the sea but many couples breed far away on the inland pasture lands where the country is to some extent drained and the deep swamp is replaced by the very wet muddy pasture-land on which the Finnish cattle are turned out in July and August. Here however I never met with any colonies, generally only single pairs were found and never more than two or three. The nests are like those of the Little Stint, just neat little cups composed of a small amount of grass wedged in amongst the roots of the growing grass. The birds seem always to prefer cover which is quite short, generally a few inches high only, and no great attempt seems to be made at concealment. On the other hand the birds do not sit nearly as closely as does the Little Stint and the nests therefore take more finding; at the same time they are not really wild, generally getting up from their nests when one is ten or twenty paces away and often returning immediately one's back is turned, while, once the eggs are very hard-set, they will occasionally sit until almost touched.

The eggs of course number four as usual and cannot, in my opinion, be distinguished from those of the preceding bird. At the same time, as a series they are not so large and the blotches are not so big, nor are the eggs as a whole quite so richly coloured. With these exceptions the description given for the eggs of *minuta* would do equally well for *temminckii.*

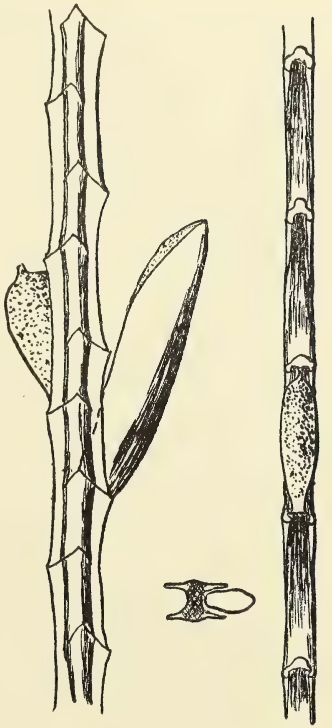
Jourdain gives the average of 100 eggs as 27.9 × 20.4 mm., maxima *30.5* × 20.8 mm.; and 28.8 × *21.5*; minima *25.5* × 20.8 and 28.2 × *19.4* mm.

The breeding display of this little bird is very charming. When one first arrives on the breeding ground where there are several pairs of birds nesting, one hears overhead and on all sides of one a most beautiful little trilling note continued for some seconds and, on looking up, one sees what appears to be a large butterfly. This, on a closer look, proves to be this tiny wader, its head held high up and wings beating the air with incredible rapidity as it hovers and sings; then, still singing, it descends in wide curves to some rock or other point of vantage near its nest, where it again utters its beautiful note. Undoubtedly the hen bird sometimes trills and displays for, from the first nest I ever found, I put up first one bird which rose trilling into the air and, while he or she was so engaged, the other bird returned to the nest and when I put that up, he or she did exactly the same. The greater part of incubation is carried on undoubtedly by the male but the female takes a share in it, sitting while the male is away feeding. We noticed that the birds sang and performed to a greater or less extent throughout the whole day and as in most cases the bird we put off the nest was the male, I think many females must have been in the air trilling.

*Habits.*—There is really nothing one can say about the habits of this little wader in addition to what has already been said about the habits of the Little Stint. They arrive at the same time and depart at the same time, i.e. in April and the first week in May and they are found in the same kinds of places and in company with the same kinds of other birds. Food, flight and actions are also precisely similar.

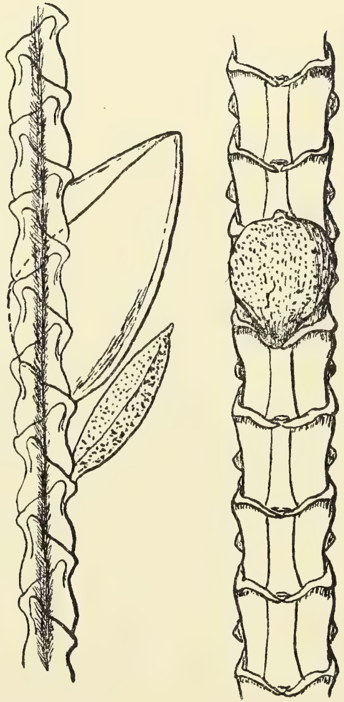
(*To be continued*).

PLATE I.

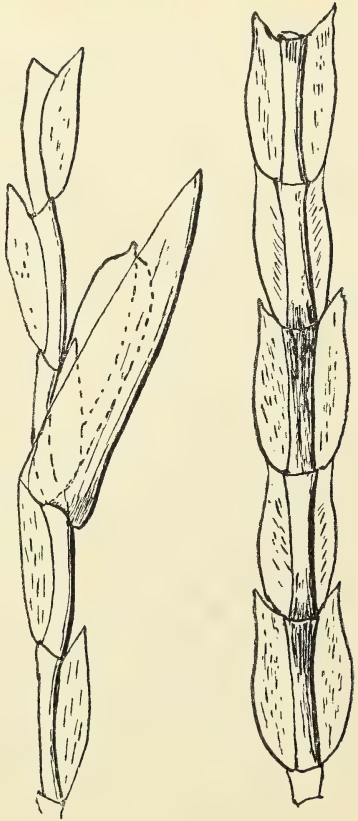


Del. C. McCann.

Rhachilla in the genus *Pycreus*.



Rhachilla in the genus *Juncellus*.



Rhachilla in the genus *Cyperus*.

# REVISION OF THE FLORA OF THE BOMBAY PRESIDENCY.

BY

E. BLATTER, S.J., Ph.D., F.L.S.

PART XXIII.

(*Continued from page 795 of volume* xxxvi).

## CYPERACEAE.

BY

E. BLATTER, S.J., Ph.D., F.L.S. and C. McCANN, F.L.S.

(*With 3 plates*).

CYPERACEAE (Cke. ii, 851).

### MORPHOLOGY.

**Seedlings:** Little work appears to have been done on the seedlings of this order. Most of the seeds are shed at mid-monsoon or after, with the exception of those species that mature early. At this early stage *Cyperaceae* often are hardly recognizable from grasses, and are consequently overlooked. Some species have leaves only at this early stage, and these are lost later on. The seedlings of *Scirpus articulatus* Linn., for example, produce at this period leaves which are strap-shaped. In this state the plant does not look at all like one of the *Cyperaceae.* Soon after the appearance of the flowering culms and the drop in the level of the water, these leaves are shed, and the culms alone remain. As the collecting is mostly done soon after the monsoon, it is but natural that the specimens thus far collected are devoid of leaves. And this also accounts for the fact that the description records—leaves 0. The seedlings of *Cyperus corymbosus* Rottb. are another instance in point. Long leaves are developed in the seedlings of this species, while in old specimens the leaves are mere vestiges, sheaths alone encircling the culms.

We are of opinion that no *Cyperaceae* are ever devoid of leaves as described in the Floras; leaves at least develop in the seedling, though they may be shed sooner or later.

**Rhizomes:** *Cyperaceae* may be divided into two classes: (1) Those which die down completely after reaching maturity, in one short season. These have fibrous roots in all cases. (2) Those with an underground rhizome which throws up culms during the period of vegetation, or as long as the supply of moisture lasts, and then dies down above the surface of the soil and remains dormant till the next favourable opportunity. We refrain from using the terms 'annual', 'biennial', 'perennial', etc., as they certainly do not appear to be correct in their application in many of the species. The term 'annual' may be suitable to those with fibrous roots, but the other terms do not rightly describe the species with rhizomatic underground stems. The rhizomes in the same species may be very short with short nodes and the culms appearing caespitose, or they may be long, developing into creeping rhizomes with elongate joints and distant solitary culms.

Unless the complete plant is represented in the herbarium, it is next to impossible to distinguish the 'annuals' from the 'perennials'. Plants belonging to the first division have all fibrous roots, and do not call for any further comment here. Good examples are *Cyperus compressus* Linn., and *Pycreus pumilus* Dom. Many of these 'annual' species bud off at the base, but do not give rise to rhizomes or stolons. This process of budding is frequently responsible for tufted stems.

In *Cyperus corymbosus* Rottb. a thick long blackish rhizome is developed which gives off culms at intervals. The distance varies with the nature of the soil. The terminal anterior end of the rhizome at first produces a tuft of leaves (3-4) and from between these there appears the culm; when growth has proceeded so far, another growing point is developed which carries on the development of the rhizome. In *Scirpus littoralis* Schrad. the rhizomes are thin and long in appearance, like a stolon (Clarke does not seem to distinguish between a rhizome and a stolon). This type of growth often makes the plant appear as though it were planted in straight rows. In *Cyperus rotundus* Linn. the rhizome is ovoid (perhaps better referred to as a tuber) and thin wiry stolons are developed, connecting one tuber with the other. Tubers are developed at the extremities of each stolon. In *Mariscus paniceus* Vahl, the rhizomes are short and hard, in fact woody. In *M. konkanensis* Sedgwick, we have short hard rhizomes which give off numerous ovoid or subspherical tubers from the apex of which new individuals arise. As these tubers are frequently in a dense mass the stems appear as though they were densely tufted.

Rhizomes are generally covered with black-brown scarious scales, but we are inclined to believe that in some cases these scales are the remains of sheaths which split with the development of the rhizome and thus appear like scales. In fresh specimens of *Cyperus pilosus* we have found bluish purple lanceolate scales attached to the nodes of the rhizome. In *Cyperus bulbosus* Vahl, these scales form a very distinctive character and, when they are present in the specimens, this species cannot be confounded with *C. rotundus* Linn. with which it is often confused.

The rhizome certainly forms a very useful character in determinating species, but is not a reliable guide in all cases.

Clarke, in his excellent paper 'On the Indian species of Cyperus', makes the following statement: 'The whole of the *Exaltati* (in which I include the *Papyri*) are without stolons.' This, to our knowledge, is not correct, as we have found thick, hard, black rhizomes in *Cyperus exaltatus*. They are such large plants that they are rarely collected complete, and this may account for Clarke's opinion that they are devoid of rhizomes. If these plants are extracted from the ground without digging the stems generally come away with only a tuft of roots.

The roots of *Cyperaceae* vary much in the same species depending on the locality in which they grow. Thus in *Juncellus pygmaeus* we have observed the roots to be thick and spongy in soft waterlogged soil, while on drier sandy soil we have found them to be thin and very short. In the former case the size of the plant is small, while in the latter it is large.

**Culms:** The culm may be erect, decumbent, prostrate, or semi-scandent as in some of the forest-inhabiting *Scleria* in which the culms frequently reach a considerable length and in consequence use their neighbours as a means of support. The culm may be solitary, tufted, or arranged at intervals along creeping rhizomes. It may be naked, as in some of the *Scirpus*, with the exception of the sheaths which clothe it for a short distance up; or it may be leafy as in some of the *Scleria*. It is never branched except in the region of the inflorescence as in the case of *Scleria* and *Carex*. The stoutness of the culm varies considerably, but it is never very thick.

The culm is generally trigonous; but in some species this character is modified till the culm appears terete, and even triquetrous. In some cases the modification is carried still further and the stem appears winged. Below, the culm is invariably round, and gradually the shape characteristic of the species makes itself apparent until the position just under the umbel is reached, where it is generally more accentuated, though the common form at this point is trigonous. In *Scirpus articulatus* Linn. the stem is terete, while in *Cyperus exaltatus* it is trigonous. Again in *Scirpus grossus* the stem is sharply triquetrous, while in *Cyperus flavidus* Retz. the culm appears fluted. The culms of most *Cyperaceae* are solid, but there are some that are hollow and septate; in both *Cyperus articulatus* and *Scirpus articulatus* we find the latter condition. For the most part the culm is glabrous, but there are some species in which the angles of the culms are distinctly scabrid, so much so that they present a sharp cutting edge. Some culms are striate (many that are not striate in the fresh state present this character in the herbarium), while others are quite smooth. In some cases the culm is 'highly polished' and shining, while in others it is dull and in the case of *Fimbristylis tetragona* R. Br. the stem is covered with a greyish powdery substance.

The character of the stem is fairly constant in the same species, but there are cases in which there is a distinct difference in the same plant, as noticed in *Pycreus globosus* All. The true character of the stem is more often than not lost in herbarium material.

**Leaves:** The leaves are generally narrowly linear and grasslike in appearance, canaliculate above and carinate below, but unlike those of the *Gramineae* they are devoid of a ligule. They may be longer or shorter than the culm, or entirely suppressed. In some cases they are basal, but in others they are cauline, some ascending from one-third to half way up to the culm and in others, like *Scleria*, nearly to the top. In rare cases they are short-lived, decay and fall away. In *Scirpus articulatus* Linn., the leaves are developed in the seedling, but are absent in the mature plant. In *S. littoralis* Schrad., long flaccid leaves are developed, but are shed at maturity with the drop in the level of the water in which they grow. In both these species the leaves are developed under the surface of the water. In *Cyperus corymbosus* Rottb. long leaves are developed by the seedlings, and in the same plant the rhizome sends forth leaves at its apex; after the appearance of the culm these leaves disappear, leaving sheaths surrounding the base of the culm.

The leaves are usually long and flaccid, but in some instances, as in *Remirea maritima,* they are short and stiff. In *Mariscus compactus* Druce they are long and stiff, being very thick. The leaves are generally glabrous, but in some cases they are scabrid as in *Mariscus compactus;* sometimes only the upper surface is so, in others both surfaces are affected, while in others again they are scabrid on the nerves. The midrib is usually canaliculate above and very prominent below. Many longitudinal nerves are developed in the leaves, certain of which are more prominent than others in some species. The length of the leaves is a very poor character for diagnostic purposes as it varies considerably in the same species or even specimen.

**Sheaths:** We think that the sheaths enclosing the base of the culm are not always the remains of the leaf-sheath or sheathing petiole, but are of much the same cataphyllous nature as in the *Araceae.* In *Scirpus articulatus,* for example, the leaves are only developed in the juvenile stage, and not in the mature plant; no appendages are developed at its extremity. In *Cyperus corymbosus* Rottb. the same type of sheath is developed, but unlike that of *Scirpus articulatus.* Sometimes long leaf-like appendages are developed, and the Floras have treated them as leaves. Though, morphologically speaking, they are perhaps derived from transformed leaves, we hardly think that they should be treated as such in those species presenting this particular type of sheath. It is only in those species which have a naked stem in the mature state that we find these cataphyllous structures.

In the case of *Scleria,* for example, the sheaths encircling the culm are undoubtedly the remains of the leaf-stalk. In this case, as growth proceeds, (in tall forest species) the leaves in the lower portion are shed leaving the sheath encircling the culm.

**Bracts:** Long or short bracts are present in most *Cyperaceae*, but there are many cases in which they are reduced to mere vestiges or are altogether suppressed. In appearance, texture, nervation, and scabrousness etc., the bracts invariably resemble the leaves. The bracts are in most species apparently umbellate, but are really always alternate. They are usually divaricate or erect-patent; but in some species the lowest one is nearly erect or in some cases appearing as if it were a continuation of the culm, and in these instances the umbel appears as though it were lateral, as in *Cyperus laevigatus,* and in some cases of the genus *Scirpus.* The bracts are best represented in the genus *Cyperus* and in *Scirpus grossus.*

The character of the bracts is useful in recognizing some of the species, but on the whole of little value particularly in respect to their length. From the axil of each bract springs a ray; the number of rays is never in excess of the bracts though this may appear so in some species when the bracts are suppressed. The lowest bract is usually the longest, and as we go higher the bracts diminish in size till they disappear. In the case of compound and further divided umbels, bracteoles are developed at almost every division of the ray till the base of the spikelet is reached, where there are generally one or two empty glumes. These bracteoles behave in much the same way as the bracts and diminish in size the higher they go.

**Inflorescence:** The inflorescence may be composed of solitary, fasciculate, paniculate, or spicate spikelets. In *Kyllingae* the inflorescence is reduced to a dense capitellum or head, and this is also the case in some species of *Cyperus* and *Mariscus*. In the majority of the larger *Cyperi* the inflorescence is umbellate, compound, decompound and so on, which makes them very difficult of description. In the genus *Carex* we frequently have a paniculate or spicate arrangement. The compact heads of the *Kyllingae* and the large compound inflorescence of the *Cyperi* appear to us to be the result of the contraction of the upper part of the culm. The rays of the inflorescence are much like the culm in character. Upon the rays are arranged its branches or the spikes, as the case may be. The ultimate unit of the inflorescence is the spikelet.

*Spikelet*: At the base of every spikelet there are usually present one or two empty glumes. It is hard to ascribe their true nature to these structures, but we are inclined to believe that they are the result of modified bracteoles, as, in some instances, they certainly appear to have originated from this source. The glumes that subtend each floret are arranged along a central axis, the rhachilla. The glumes appear to be not far removed from the lower empty glumes, though in most cases they differ in configuration. It appears that these glumes are nothing more than bracteoles and not true floral investments, and that the true floral investments are represented by the 'hypogynous bristles' that are to be found in some of the genera such as *Scirpus, Eleocharis*, etc., and may be regarded as a primitive character. Within each one of these glumes is to be found the floret, whether male or female. In this connection we are of opinion that the so-called spikelet is in reality a spike and the floret the ultimate division of the inflorescence.

The glumes are either distichously or spirally arranged along the rhachilla. The rhachilla varies considerably in shape and length, it may be winged or not. The wings are undoubtedly formed by the decurrent margins of the glumes, though this is not very noticeable unless very carefully examined. The *Cyperi* are most interesting in this respect. In *C. corymbosus* Rottb. the rhachilla is broadly winged by the decurrent margin of the glume. In some cases the colour of the wing is given as a diagnostic character; but this point certainly cannot be relied on, as we have noticed that in this particular species when the inflorescence is young the wings are hyaline and gradually become browner as it gets older; thus the colour depends very much on the age of the inflorescence. The wings of the rhachilla are within the glume, below the one from which it is the decurrent margin and embraces the nut.

The colour of the glumes like that of the wing of the rhachilla is a dangerous character and should be used with circumspection, particularly in herbarium material. The glumes may or may not be nerved, but when this character is present it forms an useful combination with the other characters of the species.

**Stamens:** There are usually 1-3 stamens. The number of stamens in the same species is usually a constant character, but occasionally there are exceptions to this rule. The filaments are flattened or ligulate, frequently becoming a little broader above. In some species the filaments persist for a long time after the glumes have fallen. In this case the anthers drop off.

**Style:** The style may be short or long, and may be either 2-fid or 3-fid; the branches are usually long and linear. The style proper, or the unbranched portion, is sometimes variable in character—trigonous, triquetrous, or almost winged. It may be glabrous or papillose.

**Nut:** The nut varies much in size, shape, and texture according to the species. It is generally 3-gonous in *Cyperus*, laterally compressed in *Pycreus*, dorsally compressed in *Juncellus*, cylindric in *Fimbristylis tetragona* R. Br. The surface may be smooth, puncticulate, tuberculate, reticulate, etc. The mature nut forms a very reliable means of determination if the shape is properly preserved in the herbarium; young nuts are very often misleading.

The colour varies considerably with the age of the nut. Microscopical examination is essential, as determination of *Cyperaceae* from this character with a pocket lens or a very low power cannot be relied upon.

### FERTILIZATION.

Nothing of value has so far been observed with regard to pollination in this order. Muller, in his work on 'The Fertilization of Flowers', glosses over the subject with the remark that the flowers are aneomophilous, and says that he has observed certain of the *Carices* visited by the hive-bee. The anthers are no doubt suited for this type of fertilization, though this is not the only one the order depends on. If we examine the fruiting spikelet of any of the *Cyperaceae* it will be noticed that all the florets have been fertilized and bear nuts. Wind pollination in itself would not be responsible for this fertility throughout. How then are we to account for this prolific fertilization? In our experience this is effected in the following manner: The lowermost floret in the spikelet develops first—here the anthers are matured before the stigmas. This is true in some cases but not in all. As growth advances, the florets develop in acropetal succession from below upwards and in all cases the anthers mature before the stigmas. Now when the lowest stigmas are ripe the anthers in the floret above it are mature. With the weight of the anthers and the aid of the wind the stamens are deflexed and the anthers of the floret are brought in contact with the stigmas of the floret just below it—thus bringing about its fertilization. In other words both self-fertilization and cross-fertilization are common. If these plants were dependent on cross-fertilization not all the florets in the spikelet would be capable of producing nuts—there would be some barren ones. During the period in which most of the Cyperaceous plants are in flower, which is during the monsoon months, there is usually little wind that is not accompanied by heavy downpours, so that whatever is in suspension in the air is washed to the ground. In the intervals between the showers little cross-ferilization could take place.

Species that grow in forests are generally protected from the wind, yet complete fertilization is effected. In the cases of *Carex* with monoecious flowers, the male flowers are situated above the female, and it is possible that when the anthers are ripe the pollen is shed and falls directly downwards on to the stigmas below. In this case the stigmas and anthers ripen at more or less the same time. But we have not had sufficient experience to express definite views on the subject, as far as this genus is concerned. No doubt insects visit some of the *Cyperaceae*, but they are few; and we think it hardly possible that every spikelet in a whole umbel should have all the florets in each spikelet fertilized in this way. Even so there is little chance of cross-fertilization, as the visiting insect may carry pollen from one part of the inflorescence to another part—this again would result in self-fertilization in so much as the pollen is from the same individual plant. The passage of insects over the spikelets would have the same result to a large extent by the deflection of the stamens.

The net result of these observations is that self-fertilization is not uncommon in this order, each set of anthers of a floret fertilizing the stigmas of the floret below it. However, there remains a great deal of work still to be done in this direction.

### SEED DISPERSAL.

Ridley in his excellent work on the 'Dispersal of Plants throughout the World' (p. 99) rightly remarks that *Cyperaceae* do not depend very much on the wind for the dispersal of seed; we are of opinion that a certain amount of dispersal is effected in this way (though very local) in the case of plants which dry erect, and in the case of those that inhabit desert regions in the drifting sand. However, the greater part of the dispersal is probably effected by water and animal agents. Under the heading of water we might make three divisions and consider them separately: (*a*) Monsoon wash, (*b*) floods, and (*c*) rivers.

**Monsoon wash:** Many of the *Cyperaceae* fruit long before the monsoons terminate, for instance *Fimbristylis digitata*, *Rynchospora Wightiana*, and a few others. The two plants mentioned above are soon overtopped by other vegetation. The seeds drop to the ground and are probably washed away by the subsequent showers of rain. *Cyperus rotundus*, a common pest in our area, and *C. compressus* also flower early during the monsoon. The inflorescences break up, and they must be dispersed in the same way.

**Floods:** Floods, though not very largely responsible for the dispersal of seed must nevertheless disperse a good deal at the first onrush; and not only seed, but also entire plants and underground portions. Thus, Clarke states (ex Ridley), *Cyperus cephalotes* and *C. platystylis* are dispersed. Both species form floating masses in tanks and ricefields. Large quantities of earth are also washed away and in this there surely must be quantities of seed, etc.

**Rivers** : Along the banks of rivers and streams numerous *Cyperi* grow and it is doubtless that many seeds fall into the water directly or indirectly; whether the seeds sink or float is immaterial for they are certainly washed along with the silt. Now the banks of rivers are always changing, large masses of earth with the vegetation fall into the stream and are washed down whole.

**Animals;** We think animals are the greatest agents for the dispersal of seed. In this case the seeds may be carried internally or externally for great distances before they are dropped.

*Internally*: Many animals eat Cyperaceous plants along with other herbaceous vegetation. We have observed cattle eat *Cyperus Iria*, inflorescence and all. It is quite possible that many of these seeds are proof against the gastric juices and pass out unchanged in the droppings. Elephants after they have uprooted a 'trunk full' of stuff are in the habit of dusting the tuft on their bodies either for the purpose of freeing it of obnoxious insects or for driving away tantalizing insects and in so doing disperse the seed.

Beasts of prey kill a number of herbivorous animals, and the stomach contents are left where the prey has been eaten. We have frequently come across quantities of seeds left in this way.

*Externally*: The seeds of *Cyperaceae* fall to the ground and are soon mixed with the wet soil during the monsoon and in marshy ground. Animals passing through these muddy tracts collect a quantity of the mud on their legs and in between their hoofs, and in this way carry seed from one place to another. Wallowing animals such as pigs, elephants and the buffalo carry away clots of mud on their bodies which in all probability contain seed. These do not leave the animal till dry. In the meantime the animal may have travelled far from the place where it collected the earth.

**Birds ;** Numerous birds such as quail, partridge, and grouse, eat the seeds of Cyperaceous plants; but it is quite likely that in these cases the seeds are digested, as they constitute the food of these birds. Large numbers of grain feeding birds are killed by birds of prey whereby the contents of the crops are discarded.

But the greatest chance of dispersal lies with the swimming and wading birds who visit places where *Cyperaceae* grow in abundance, such as rivers and lakes. These birds invariably collect quantities of seed on their plumage as they brush through the vegetation on the banks of the rivers and lakes, and on their bills and feet with the mud which adheres to them, and is in this way transported great distances.

**Man ;** Man is by no means to be overlooked in this connection as there is no doubt that he transports many species with articles of commerce such as grain, grass, and other produce of the fields. Few Cyperaceous plants are transported from one place to another for garden purposes. Some are cultivated by the poorer classes in India, such as *Scirpus grossus*, for their edible tubers, while *Cyperus corymbosus* is said to be cultivated for purposes of mat making; but in either case this cultivation is by no means systematic.

## HERBARIA EXAMINED.

(1) Herbarium of St. Xavier's College, Bombay.
*Collectors*: Blatter, Hallberg, McCann, Sabnis, D'Almeida (a few specimens), and Vakil (a few specimens).

(2) Herbarium of Sedgwick and Bell (now) at St. Xavier's College, Bombay.
*Collectors*: Sedgwick, Bell, and their collectors.

(3) Herbarium of the Economic Botanist (H.E.B.B.), Agricultural College, Poona.
*Collectors*: Gammie, Paranjpye, Bhide, Garade, Patwardhan, Chibber, Ryan, and Cooke.

(4) Herbarium of Talbot (now) at The Agricultural College, Poona.
*Collector*: Talbot.

(5) Herbarium of the Botanical Survey of India, Sibpur, Calcutta.
This herbarium is extremely poor in material from the Bombay Presidency. The specimens are mostly a few duplicates from the Poona collection.

(6) Herbarium of Woodrow (now) at The Bombay Natural History Society, 6, Apollo Street, Bombay.
A poor collection—few sheets having any definite locality.

(7) Herbarium of Dalzell (now) at The Imperial Forest Institute (H.I.F.I.), Dehra Dun.
Poor material, and without any precise locality—just 'Bombay Presidency'.

(8) Herbarium of the Gujarat College, Ahmedabad.
*Collectors*: Sedgwick and Saxton.

(9) Herbarium of McCann, Bombay.
*Collector*: McCann.

## Some General Notes.

This is perhaps one of the most difficult orders to work out for many reasons.

(1) The development of *Cyperaceae* from the seed to the mature plant often presents several different stages.
(2) Wet and dry season forms offer many varying characters.
(3) Specimens growing in or near water differ from those occupying drier soil.
(4) If characters are not noted in the field they are generally lost in herbarium material, and only personal touch and constant work both in the herbarium and in the field can clear these difficulties.
(5) Size of individuals depends much on the type of soil and season at which they are collected.
(6) Like the *Gramineae* most of the *Cyperaceae* will grow out of season if in suitable localities; but these specimens usually present certain characters unlike the 'proper season' forms.

Key to the genera (after Fischer):

A. Nut not enclosed in an utricle
I. Nut-bearing glumes containing perfect stamens as well
1. Empty glumes at base of spikelets 0-2
a. Glumes distichous (see also 8. *Fimbristylis*); hypogynous bristles 0
* Stigmas 2
† Rhachilla deciduous as a whole ... 1. *Kyllinga*.
†† Rhachilla persistent
§ Nut compressed radically to the rhachilla ... ... ... 2. *Pycreus*.
§§ Nut compressed tangentially to the rhachilla ... ... ... 3. *Juncellus*.
** Stigmas 3 or style subentire
† Rhachilla persistent ... ... 4. *Cyperus*.
†† Rhachilla deciduous above the 2 lowest glumes leaving a knob
§ Keels of nut-bearing glumes not winged ... ... ... 5. *Mariscus*.

§§ Keels of nut-bearing glumes winged 6. *Courtoisia.*
b. Glumes spirally arranged (basal ones sometimes distichous in 8. *Fimbristylis*); hypogynous bristles or scales sometimes present
* Style-base dilated and constricted or articulated above the nut
† Hypogynous bristles present; style usually persistent; leaves 0 ... 7. *Eleocharis.*
†† Hypogynous bristles 0; leaves usually developed
§ Style-base often persistent, if falling not leaving a tumour on the nut; leaves sometimes reduced to sheaths 8. *Fimbristylis.*
§§ Style deciduous, leaving a tumour on the nut ... ... ... 9. *Bulbostylus.*
** Style-base not dilated, continuous with the nut
† Hypogynous bristles not hyaline, sometimes 0, not enveloping the nut
§ Nut with hypogynous bristles. Style-base not swollen ... ... 10. *Scirpus.*
§§ Nut with 6 hypogynous scales, divided to the base into linear segments; stigmas 3 ... ... 11. *Eriophorum.*
§§§ Nut with 6 or 3 or 0 scales which are not divided into segments, but petal-like. Stigmas 3 ... ... 12. *Fuirena.*
†† Hypogynous bristles 2, hyaline, elliptic, enveloping the nut ... ... 13. *Lipocarpha.*
2. Empty glumes at base of spikelets 3 or more
a. Stigmas 2; style-base dilated, not continuous with the nut; not beaked by the persistent style-base ... ... ... 14. *Rhyncospora.*
b. Stigmas 3-fid. Lowest fertile glume somewhat distant from the one above it. 15. *Schoenus.*
c. Stigmas 3; style-base not dilated; nut not beaked ... ... ... ... 16. *Remirea.*
II. Nut-bearing glumes devoid of perfect stamens
1. Spikelets 2-sexual; female flower solitary, terminal; nuts not bony ... ... 17. *Hypolytrum.*
2. Spikelets 1-sexual or the female flower basal; nuts bony
a. Spikelets usually 2-sexual, female flower basal ... ... ... ... 18. *Scleria.*
b. Spikelets unisexual, female flower terminal ... ... ... ... 19. *Diplacrum.*
B. Nut enclosed in an utricle
Spikelets many-flowered; flowers 1-sexual; rhachilla persistent; glumes not spathiform. 20. *Carex.*

### 1. KYLLINGA Rottb. (Cke. ii, 876).

Species about 50.—Tropics and subtropics.

The members of this genus are readily recognized by the capitate inflorescence at the termination of the culms. The heads vary in number from 1-7, are coloured light green, dirty white or pure white. Though the genus is easily distinguished, the species are somewhat difficult to identify.

The *Kyllingae* are for the most part monsoon species, but will flourish where there is sufficient moisture. *K. brevifolia* is particularly hygrophilous and will grow throughout the year along the banks of streams and other wet places.

Cooke in the Flora of the Bombay Presidency mentions two species: *K. triceps* and *K. monocephala.* To these Sedgwick (Journ. Bom. Nat. Hist.

Soc. 'The Cyperaceae of the Bombay Presidency') adds two more: *K. melanocephala* and *K. brevifolia;* to these we now add one more: *K. squamulata*. Sedgwick obtained specimens at Khandala, and there were some specimens in the Herbarium of St. Xavier's College; but he was not sure of his identification. This species, though on the whole very distinct from the others occurring in the Presidency, varies much with regard to the conical teeth on the back of the glumes, even in the same head which, though given as a specific character, is not very constant.

The *Kyllingae* are very distinct when seen fresh in the field and not difficult to recognize, but herbarium material is very misleading as not much reliance can be placed on the absence or presence of the keel—this point varies too much in the same specimen. The colour of the heads, if noted when fresh, forms a very good guide, at least as far as the Bombay material is concerned.

I. Rhizome very short or 0; stems close
  1. Keel of nut-bearing glume not crested
    a. Rhizome practically 0; stems not robust, more or less thickened at the base; heads usually 3, rarely fewer or 4-5, cylindric-ovoid, central one up to 1 cm. long, others smaller, 2 upper glumes narrow ... 1. *K. triceps.*
    b. Rhizome horizontal, thick; stems 2-many, rather robust, up to 0.9 mm. high, acutely 3-angled at summit; head solitary, subglobose or ovoid, up to 1 cm. long; keel of glumes smooth, tip excurrent ... 2. *K. melanosperma.*
  2. Keel of nut-bearing glume with a broad, hyaline, toothed crest; head usually solitary, subglobose, 4.2 mm. diam.; keel of glumes excurrent and recurved ... ... ... 3. *K. squamulata.*
II. Rhizome elongate, clothed with oblong brown scales, stems spaced, rarely close
  1. Leaves usually much shorter than the stems; head usually solitary, subglobose or ovoid, up to 7.5 mm. long; keel of glume setulose; nut elongate ... ... ... ... 4. *K. brevifolia.*
  2. Leaves as long, longer or shorter than the stems; head usually solitary, ovoid, up to 1 cm. long; keel of nut-bearing glume with a lunate, entire crest; nut suborbicular ... 5. *K. monocephala.*

This is a copy of a key sent to C. McCann by C. E. C. Fischer which he has used in the meantime for his Flora of Madras.

1. **Kyllinga triceps** Rottb. Descr. *et* Ic. (1773) 14, t. 4, fig. 6 (*exclusa Rheedsi tab. et aliquibus synonymis*); Cke. ii, 877.

*Description*: Cke. ii, 877.

*Locality*: Without locality (Dalzell, H.I.F.I. !).—*Sind*: (Pinwill ex Cooke).—*Gujarat*: *Ahmedabad* (Sedgwick !; Herb. St. X. C. 2164 ! 3176 !). —*W. Ghats*: Khandala (Blatter, Hallberg & McCann 2405 ! 27417 !); Panchgani, exceedingly common (McCann !), Tableland (McCann 2804 ! 2872 !); Pasarni Ghat, near Panchgani (McCann 3036 !).—*Deccan*: Lena Hill, Nasik (Blatter & Hallberg 2362 !); Deolali (Blatter & Hallberg 2359 ! 2834 !); Kirkee, Mr. Gammie's compound (Garade 481 ! 555 !); Poona (Jacquemont 345 ex Cooke; Woodrow ex Cooke).—*Konkan*: Sion (Blatter, Hallberg & McCann 2431 !).—*S. M. Country*: Badami Hills (Paranjpye !); Dharwar, 2,400 ft., rainfall 35 in. (Sedgwick 2684 ! 6210 !).

*Flowering & fruiting*: May 21, 1902 (Kirkee); June 18, 1902 (Kirkee); July 1917 (Sion, Khandala, Dharwar); August 1914 (Ahmedabad); August 1919 (Dharwar); August 16, 18, 25, 1930 (Panchgani); September 1917 (Lena Hill, Deolali); September 1, 1912 (Badami Hills); September 3, 1930 (Pasarni Ghat).

*Field notes*: Usually a short tufted species of the drier parts of the Presidency during the rains, growing on well drained ground. The heads are pale straw-coloured and quite unlike those of the other species recorded from the Presidency. In habit usually quite erect and growing in the open. The usual 3-headed inflorescence differentiates it from the other species but we have seen specimens with as many as 5-7 heads forming one compact head, appearing lobed.

'Abundant in pastures in the mid-monsoon period at Dharwar' (Sedgwick). 'A member of the sand flora' (Saxton & Sedgwick).

*Distribution*: Sind, Gujarat, Deccan, Konkan, S. M. Country, N.-W. India, Rajputana, Bengal, Burma.—Ceylon, Africa, China, N. Australia.

2. **Kyllinga melanosperma** Nees in Linnaea ix, 286; Boeck. in Linnaea xxxv, 419.—*K. brevifolia* Nees l.c. 91 (*partim, non* Rottb.)—*K. fuscescens* Boeck. l.c. 421 (*partim*).—*K. vaginata* ( *et* var. *major*) Zoll. Verz. Ind. Archip. ii, 63.

*Description*: Rhizome thick, 1.3-3.8 cm. long. Stems 50-75 cm. long, triquetrous under the inflorescence. Leaves much shorter than the stems, often 10-15 cm. long, 4-5 mm. broad. Head of one spike, ovoid, dull green, 8 mm. long and more; bracts 3-4, similar to the leaves, the lowest often 10 cm. long. Spikelets numerous 3-4 mm. long, each producing 1 (very rarely 2) nut. Nut-bearing glume ovate, acute; keel not winged, almost smooth. Nut $\frac{1}{2}$-$\frac{2}{3}$ the length of the glume, narrowly obovoid, finally black.

*Locality*: *W. Ghats*: Panchgani, Maratha Well (Blatter & Hallberg B1738 !).—*S. M. Country*: Devarayi, 1,800 ft., rainfall 90 in. (Sedgwick 4413 !).—*N. Kanara*: Sampkhand, river bank, 1,600 ft., rainfall 200 in. (Sedgwick 6982 !, Hallberg & McCann C215 !); Anmod, in a marsh (Sedgwick 3293 !).

*Flowering & fruiting*: October 1918 (Devarayi); October 1919 (Sampkhand); October 1920 (Panchgani); December 1917 (Anmod).

*Field notes*: A larger and coarser plant than any of the other species.

*Distribution*: W. Ghats of Bombay and Madras Presidency up to 7,000 ft., Travancore at 300 ft., Kollimalai Hills, N. Kanara, S. M. Country.—Ceylon, Malaya, S. and tropical Africa, Madagascar.

3. **Kyllinga squamulata** Vahl Enum. ii, 381; Boeck. in Linnaea xxxv, 431.—*K. Metzii* Steud. Syn. Pl. Cyp. 70.

*Description*: Root fibrous. Stems closely caespitose. Leaves often as long as the stem, 3 mm. broad. Head globose, usually of 1 spike, 8 mm. diam., green becoming brown; bracts 3, lowest often 10 cm. long, similar to the leaves, patent. Spikelets numerous, 3 mm. long, perfecting one nut. Nut-bearing glume crested by toothed scales coalescent into a wing on its keel. Nut $\frac{2}{3}$ the length of the glume, orbicular, dull brown.

*Locality*: *W. Ghats*: Khandala, on a wall (Sedgwick 7928 !, Blatter & McCann 3037 ! 3057 !); Igatpuri (Blatter & Hallberg 2807 !).—*Konkan*: At the top of the hill between Tulsi Lake and Mullund, on wet rocks (McCann 797 !); on Bund, south end of Tulsi Lake, between the blocks of stone (McCann 1280 !).—*N. Kanara*: Kanara (Metz. ex Hook. F.B.I.).

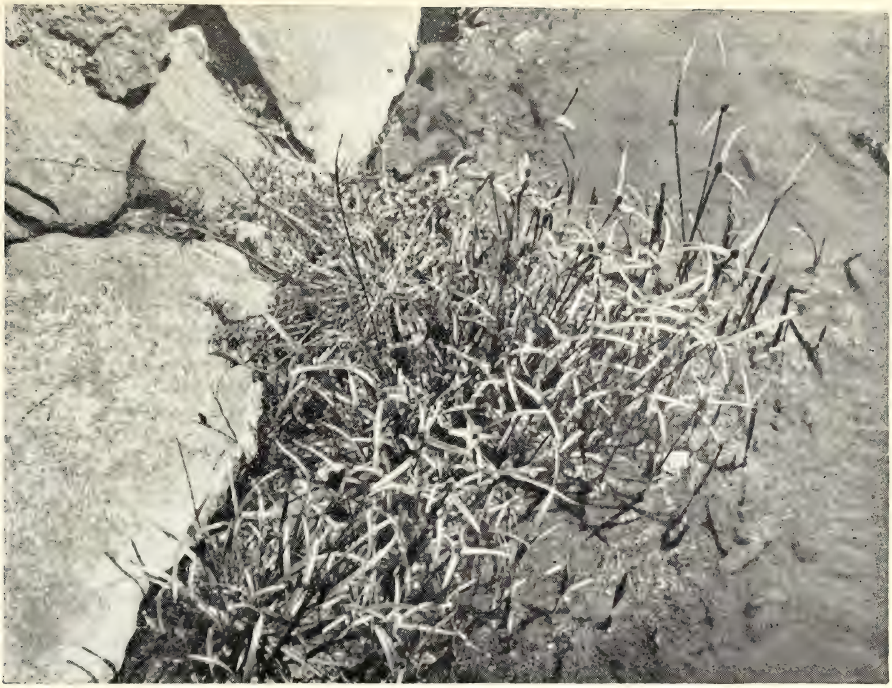
*Flowering & fruiting*: July 1916 (Khandala); July 1917 (Khandala); August 11, 1929 (between Tulsi Lake and Mullund); September 1917 (Igatpuri); September 22, 1929 (Tulsi Lake); October 1921 (Khandala).

*Field notes*: Heads a dirty white, not so compact as in the case of other species of the genus. Specimen No. 797 was growing in a dense mat on a rock over which water trickled, while specimen No. 1280 grew in between the blocks of stone of which the dam was constructed. Densely tufted.

Clarke in Hook. F.B.I. remarks that the heads are either green or brown. This may be the case in dry material but is certainly not so in fresh specimens.

The conical teeth on the back, though given as a distinguishing character of this species, are misleading as they may be present or absent even on glumes of the same head.

*Distribution*: W. Ghats, Konkan, S. Kanara, Kashmir, Garhwal up to 5,500 ft., Mt. Abu.—Tropical Africa, Martinique.



*Kyllinga brevifolia* Rottb. growing in a drain.

Inflorescence of *Pycreus albomarginatus* Nees.

*Photos by C. McCann.*

4. **Kyllinga brevifolia** Rottb. Descr. *et* Ic. (1773) 13, t. 4, fig. 3; Boeck. in Linnaea xxxv, 424 (*excl. aliquibus plantis citat.*).—For synonyms see C. B. Clarke in Hook. f. F.B.I. vi, 588.

*Description*: Rhizome creeping, 5-20 cm. long, rarely more than 2 mm. thick. Stems usually distant, sometimes contiguous, not thickened by basal sheaths. Leaves longer than the stem or scarcely one-third its length, 3 mm. broad. Head of 1 (sometimes of 2-3) spike rarely more than 6 mm. diam., ovoid, of many spikelets, green finally dusky brown; bracts 3-4, similar to the leaves, lowest up to 10-12.5 cm. long, or (in the short-leaved examples) only 2.5-5 cm. long, patent. Spikelets 2.5 cm. long, each perfecting 1 nut. Nut-bearing glume acute, mostly without glands; keel not winged, nearly always scabrous. Nut $\frac{1}{2}$-$\frac{2}{3}$ the length of the glume, yellow-brown.

*Locality*: *W. Ghats*: Khandala (Sedgwick 2571 !, Blatter & McCann 3033 ! 3041 !), on edge of a stream (McCann 400a ! 400b ! 402 ! 343 ! 346 !); Matheran (Paranjpye !); Mahableshwar (Sedgwick 7650 !); Panchgani (McCann 2780 ! 3003 !, Fernandez C213 ! C214 !); Castle Rock (Sedgwick 2755 !). —*Deccan*: Poona (Blatter 3129 !).—*Konkan*: Bombay, marshy soil near water pipe (McCann 464 !); Bhandup to Vehar Lake, on bank of a stream (McCann 637 !); Bhandup (Sedgwick, Herb. Nana 7685 !); Parel (Blatter, Hallberg & McCann 3099 ! 5377 !); Sion (Blatter & McCann 5243 !); Foot of hills N.-W. of Mulland, in humus under shade of bushes (McCann 796 !).—*S. M. Country*: Devarayi, in a marsh, 1,800 ft., rainfall 80 in. ? (Sedgwick 4096 !), forests (Sedgwick 4016 ! 4099 ! 4104 ! 4110 ! 4111 !).—*N. Kanara*: Karwar, rice fields (Talbot !, Sedgwick 5073 ! 6513 !); Yellapur (Talbot !); Dandeli (Bell 4202 !); Gersoppa Falls, 1,400 ft., rainfall 200 in. (Sedgwick 7151 !, Hallberg & McCann C211 ! C212 !).

*Flowering & fruiting*: February 1917 (Parel); March 29, 1929 (Khandala); April 15, 1929 (Khandala); June 24, 1929 (Bombay); July 1917 (Khandala); July 1918 (Devarayi); July 7, 1929 (Bhandup to Vehar Lake); August 1917 (Castle Rock); August 1918 (Dandeli); August 1, 1885 (Karwar); August 11, 1929 (N.-W. of Mulland); August 18, 1930 (Panchgani); August 25, 1911 (Matheran); August 31, 1930 (Panchgani); October 1884 (Yellapur); October 1919 (Karwar, Gersoppa Falls); October 1920 (Mahableshwar, Bhandup); November 12, 1916 (Sion); December 1918 (Karwar).

*Field notes*: Perhaps the most hygrophilous species of the Presidency and also the commonest. Usually growing in soft sticky soil along the banks of streams and often entering the water. The heads are pale green. The longest bract stands almost upright as though it were a continuation of the stem. The roots and rhizome are strongly aromatic—having a 'gingery' smell. In the field it is easily distinguished at a glance from other Bombay species by its solitary pale green head and its dense matted habit and situation, but herbarium material is difficult to distinguish and requires very careful examination.

*Distribution*: Throughout India.—Ceylon, Malacca. All warm regions except the Mediterranean.

5. **Kyllinga monocephala** Rottb. Descr. *et* Ic. (1773) 13, t. 4, fig. 4; Cke. ii, 876.—For synonyms see C. B. Clarke in Hook. f. F.B.I. vi, 589.

*Description*: Cke. l.c.—This species has a distinct though narrow wing along the keel of the nut.—*K. brevifolia* has not but has from 1-4 setae.

*Locality*: *W. Ghats*: Khandala (Gammie 15385 !), Londa (H.E.B.B. !, Cooke ex Cooke).—*Konkan*: Bombay St. X. C. compound (McCann 2396 ! 2398 !), Victoria Gardens (McCann 722 ! 726 !); Sewri, Bombay Island (Blatter & McCann 3073 !); Bhandup (Blatter & McCann 2434 !); Bhandup to Vehar Lake, in shade of mango tree (McCann 642 ! 643 !); Versova (Blatter & McCann 2828 ! 2898 !); Kondita, Salsette Isl. (Blatter & McCann 2441 !); Bandra (Ryan 1400 !); fields behind Bandra Hill (Vakil C208 !); Sion (Blatter & McCann 2427 !), under shade of tree (McCann 938 ! 941 ! 942 ! 943 ! 944 !); Vetora (Sabnis 33441 ! 33521 !).—*S. M. Country*: Tadas, Dharwar Dist., shady place, 2,200 ft., rainfall 35 in. (Sedgwick 1956 !); under shade of trees, Kunnur, Dharwar Dist. (Sedgwick 4931 !).—*N. Kanara*: Yellapur (Talbot !); Karwar, on grassy ground (Sedgwick 6514 !).

*Flowering & fruiting*: May 1918 (Vetora); July 1917 (Kondita); July 7, 1929 (Bhandup to Vehar Lake); July 22, 1929 (Victoria Gardens); August 1918 (Bandra); August 25, 1929 (Sion); September 1884 (Yellapur); September 1917 (Versova); September 8, 1903 (Bandra); September 20 (Khandala); October 1891 (Londa); October 1919 (Karwar); December 1916 (Tadas); December 1918 (Kunnur); December 1919 (Victoria Gardens).

*Field notes*: Heads solitary, pure white. Anthers and filaments also pure white when fresh. The white head is a very characteristic point in this species. The anther and filaments stand straight out when fresh.

A plant of the shade, generally growing under the shade of trees where there is a good supply of humus. Not just a monsoon species, for it may be seen throughout the year in flower when there is sufficient moisture, particularly near waterpipes in gardens when they are in the shade. In the 'wild' state it dies down soon after the rains. The rhizomes run almost parallel to the surface of the ground and are never very deep.

Specimen 941 from Sion was growing among other plants and probably in consequence became very elongate in all its proportions and did not represent the usual short upright habit of the plant.

*Distribution*: Throughout India, Ceylon, Singapore.—Hot and warm regions of the Old World, except the Mediterranean.

## 2. PYCREUS Beauv. (Cke. under *Cyperus*).

Stems leafy at the base or sometimes above. Inflorescence of 1-many corymbose-subumbellate spikes, sometimes fascicled; umbel usually simple. Glumes distichous, 4-very many, 2 lowest empty, the next bisexual, the uppermost 1-3 sterile or empty. Rhachilla persistent. Stamens 1-3. Style 2-fid. Nut laterally compressed in the plane of the rhachilla.—Species about 100.—Cosmopolitan.

In the Flora of the Bombay Presidency, Cooke includes the three genera, *Pycreus*, *Juncellus*, and *Mariscus* in the genus *Cyperus*. Sedgwick in his paper on the *Cyperaceae* of the Bombay Presidency, in the Journal of the Bombay Natural History Society, follows the same system with the exception of *Mariscus* which he separates. We do not agree with Cooke's treatment of these genera, nor entirely with that of Sedgwick. Though this view is controversial we think that the characters of *Pycreus* and *Juncellus* are sufficiently distinct from those of *Cyperus*, and between themselves, to separate them into totally distinct genera. The 2-fid style (occasionally 3-fid) combined with the characters of the nut (though somewhat artificial) are of sufficient value to separate these two genera from *Cyperus*. There is also one more character (which to our knowledge has been overlooked by Cyperologists so far) which we wish to bring forward in favour of the separate treatment of these genera and that is the character of the rhachilla which is totally distinct in configuration in these three genera. This difference between the rhachilla of these three genera is perhaps best explained by way of figures (See Pl. I). In the genus *Cyperus* the rhachilla for the most part is broadly or narrowly winged by the decurrent margins of the glume, but this is not the case in the true sense of the word in either *Pycreus* or *Juncellus*. The naked rhachilla in these three genera clearly shows a distinct type and appears to be good ground for their separation.

In *Mariscus* the disarticulation of the rhachilla above the two empty glumes appears to us to be of real morphological importance. This is not the case in any of the three preceding genera. Cooke is certainly incorrect when he states that this character 'cannot be applied in the field, but may be said to be limited to herbarium specimens' (Fl. Bomb. Pres. ii, 853). We are in agreement with Sedgwick who holds the opposite view. As a matter of fact, when the spikelet of a *Mariscus* is ripe it comes away easily even at the slightest touch. Articulations are not apparent when the parts are immature. Lastly, the morphology of the spikelet including the shape and construction of the glume is far removed from the typical *Cyperus* spikelet which cannot be said of *Pycreus* and *Juncellus*.

All the species of this genus that occur in the Presidency may be classed as annuals or plants that will grow at any time of the year if in a suitable locality.

Of all the species *P. globosus* All. is perhaps the most common and shows the greatest amount of variation which makes it exceedingly difficult to define and identify. *P. albomarginatus* is the largest species that occurs in the Presidency, and is readily distinguished. *P. polystachyus* Beauv. is another variable plant.

Key after Sedgwick:

A. Superficial cells of the nut longitudinally elongate. Ripe nuts usually appearing irregularly zonate by the short sides of the cells running into a wavy line.
  1. Nut black, narrowly obovoid, subacute, not much compressed, the transverse ridges prominent, glistening white ... ... 1. *P. flavescens.*
  2. Nut black, broadly obovoid, obtuse, rather compressed, the transverse ridges distinct, not white ... ... ... ... 2. *P. latespicatus.*
  3. Nut black, quite concolorous, almost completely rotund, very compressed, the transverse ridges rather obscure ... ... 3. *P. malabaricus.*

B. Superficial cells of the nut quadrate. Ripe nuts not zonate
  1. Spikelets short, broad, 3 mm. reddish ... 4. *P. sanguinolentus.*
  2. Spikelets elongate, many-flowered, with parallel sides, 3 mm., stem robust, 30-60 cm. ... 5. *P. puncticulatus.*
  3. Spikelets gradually attenuated from base to tip, glumes lax, yellow, with prominent white margin ... ... ... ... 6. *P. albomarginatus.*
  4. Spikelets elongate (as 2) but stems slender; tufted, 20-45 cm. ... ... ... 7. *P. globosus.*
  5. Spikelets narrow, pale, in contracted umbels; perennial, maritime ... ... ... 8. *P. odoratus.*
  6. Small and slender; spikelets few-flowered with hump-backed glumes with strong, raised, curving nerves on the sides ... ... 9. *P. hyalinus.*
  7. Small and slender, spikelets many-flowered, elongate, parallel-sided, with normal glumes 10. *P. pumilus.*

1. **Pycreus flavescens** Nees in Linnaea ix, 283.—*Cyperus flavescens* Linn. Sp. Pl. (1753) 68.

*Description*: An annual, slender herb. Stems 3-30 cm. high. Leaves often $\frac{2}{3}$ the length of the stem, 2 mm. wide, grass-like. Umbel simple or reduced to one head; bracts spreading; spikelets clustered, or very shortly spicate, linear, 2.5 mm. wide, yellow or pale, spreading in fruit. Nut obovoid, compressed, shining black, with transverse white lines, hardly half as long as the glume; black cells of surface longitudinally oblong.

The Tambad specimen of Woodrow was identified as *P. malabaricus.*

*Locality*: *W. Ghats*: Khandala (Gammie 15386 !, H.E.B.B. !, McCann C197 !); Purandhar (Blatter & McCann 5584 !).—*Deccan*: Tambad, Mawal (Woodrow !).—*N. Kanara*: (Chibber !).

*Flowering & fruiting*: September 20, 1895 (Khandala); September 20, 1902 (Khandala); November 1910 (Kanara); December 1917 (Purandhar).

*Distribution*: N. temperate regions.

2. **Pycreus latespicatus** C. B. Clarke in Hook. f. F.B.I. vi, 590.—*Cyperus latespicatus* Boeck. in Flora xlii, 433 (of No. 28, July 1859, not of No. 27); Cke. ii, 855.—Synonyms in F.B.I. l.c.

*Description*: Cke. l.c. (under *Cyperus*).—Filaments persistent on the rhachilla in dried material.

*Locality*: *W. Ghats*: Mahableshwar, rocky summit of Sindola Plateau 4,700 ft., rainfall 300 in. (Sedgwick 4850 !, Ryan 1523 !); Lingmala (McCann 3419 ! 3375 !); Panchgani (Blatter & Hallberg B1747 !, Blatter 1986 !, McCann 2753 ! 2805 !), marshy banks of a watercourse (Fernandez C172 ! C173 !); Khandala (Chibber !); Lonavla (Blatter & McCann 2491 !).—*Deccan*: Mawal (Woodrow !).—*Konkan*: (Stocks, Law, ex Cooke); Borivli to Kanari Caves, in open grassland (McCann 1120 !).—*S. M. Country*: Devarayi, 1,800 ft., rainfall 290 in. (Sedgwick 4465 !).—*N. Kanara*: Sirsi, 1,600 ft., rainfall 100 in. (Sedgwick 7263 !); Yellapur (Talbot 1023 !).

*Flowering & fruiting*: August 16 and 18, 1930 (Panchgani); August 28, 1929 (Panchgani); September 1917 (Lonavla); September 20, 1884 (Yellapur); September 24 and 27, 1930 (Lingmala); October 1908 (Panchgani); October 1918 (Devarayi); October 1919 (Sirsi); October 1920 (Panchgani); November 1918 (Mahableshwar); November 9, 1893 (Mawal).

*Field notes*: Spikes reddish brown, turning reddish in herbarium material; very pale spikes are also very common.

Umbel occasionally reduced to a single spikelet. Growing in the open, usually associated with other short species.—Purely a monsoon species; tufted—many stems arising from one point—not quite erect, usually inclined at an angle, solid, one side compressed, the other rounded.

*Distribution*: W. Ghats, Deccan, Konkan, S. M. Country, N. Kanara.—More or less throughout India.

3. **Pycreus malabaricus** C. B. Clarke Journ. Linn. Soc. v, 34 (1898) 12.—*Cyperus malabaricus* C. B. Clarke l.c.; Cke. ii, 856.

*Description*: Cke. l.c.

*Locality*: *W. Ghats*: Igatpuri (Blatter in Sedgwick's Herb. 3488 !; Blatter & Hallberg 2845 !); Lonavla (Woodrow ex Cooke; Blatter, Hallberg & McCann 3146 !); Khandala (Cooke; Blatter, Hallberg & McCann 3044 !, H.E.B.B. !).—*N. Kanara*: Arbail Ghat, grassland, 1,500 ft., rainfall 300 in. (Sedgwick 6584 !); Siddhapur, grassland, 1,600 ft., rainfall 100 in. (Sedgwick 7247 !); Karwar, abundant (Sedgwick 6599 !; Hallberg & McCann C101 !).

*Distribution*: Apparently endemic.

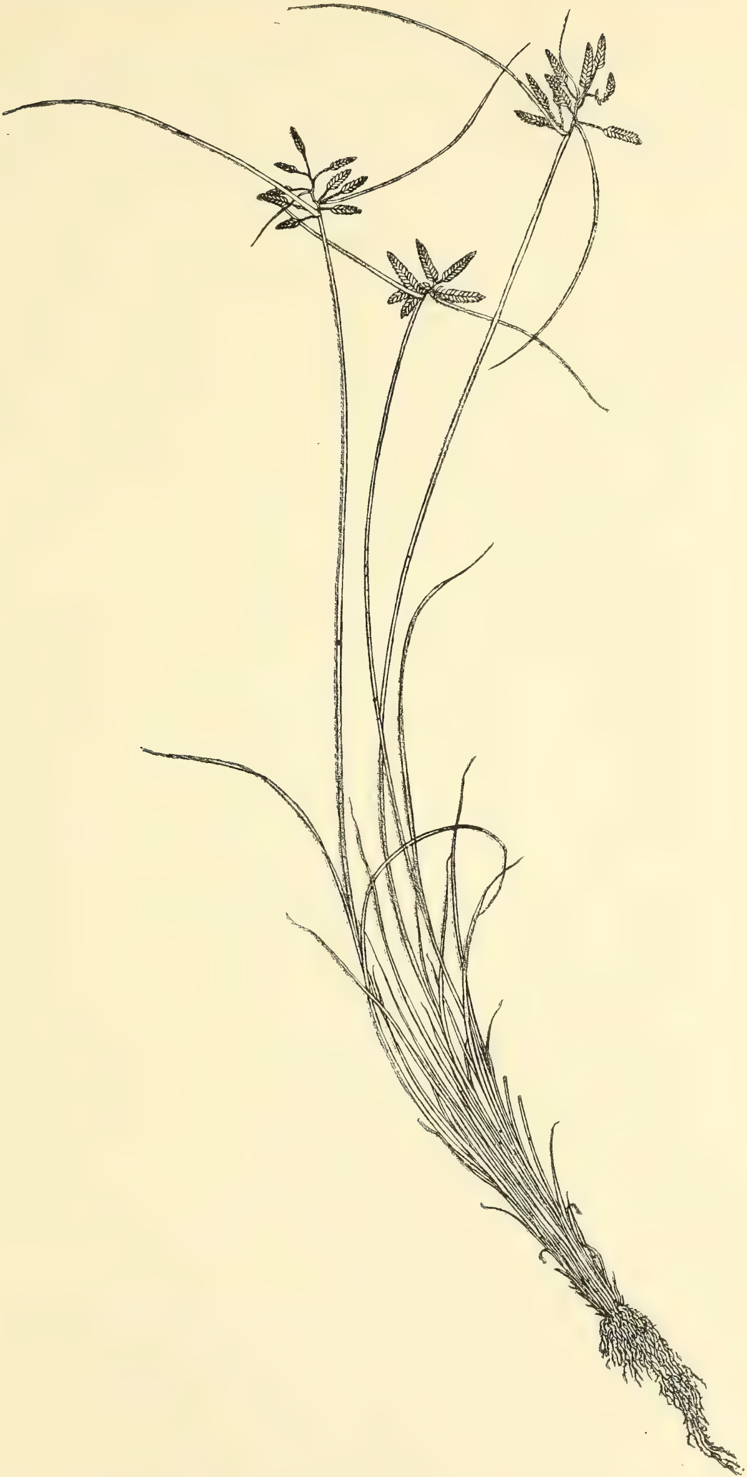
4. **Pycreus sanguinolentus** Nees in Linnaea ix (1835) 283.—*Cyperus sanguinolentus* Vahl Enum. ii (1806) 351; Cke. ii, 856.—Synonyms in F.B.I. vi, 590.

*Description*: Cke. l.c. (under *Cyperus*).—Cooke states that the spikes are 'reddish brown' and that the glumes are 'greenish yellow'. The colour reddish brown in the spikes is certainly due to the colour of the glumes which are reddish brown. We do not understand the contradiction. Further on in the description he says that the sides of the glumes are reddish brown—the margins and keel are certainly paler.

*Locality*: *Sind*: (Pinwill ex Cooke).—*W. Ghats*: Khandala (Woodrow ex Cooke, McCann 3196 ! C110 !, Blatter & McCann 3160 ! 3191 !, Gammie 15407 !, H.E.B.B. !), in a marsh near the station (McCann 389 ! 403 !); Igatpuri (Blatter & Hallberg 2810 ! 2818 ! 3009 ! 3016 !, McCann 2380 !); Panchgani, in the bed of a watercourse (Fernandez C159 !); Castle Rock, 1,600 ft., rainfall 250 in. (Sedgwick 2715 !).—*Deccan*: Talegaon (Blatter 3149 !); Khandala to Talegaon (H.E.B.B. !).—*Konkan*: Mulland, in a marsh (McCann 811 !); Kalyan (Woodrow 11 ex Cooke).—*S. M. Country*: Alnavar, 2,000 ft., rainfall 40 in. (Sedgwick 2924 !); Bidi, Dharwar Dist., 2,500 ft., rainfall 50 in. (Sedgwick 3038 !).—*N. Kanara*: Hattikeri, Karwar, in a pool (Herb. Sedgwick & Bell 6765 !, Hallberg & McCann C109 !); Karwar, in rice fields (Talbot 1516 !); Yellapur (Talbot !); Hangal (Chibber !).

*Flowering & fruiting*: March 1917, March 29, 1929, April 15, 1929, and May 1917 (Khandala); August 1917 (Castle Rock); August 10, 1885 (Karwar); August 11, 1929 (Mulland); September (Talegaon); September 1884 (Yellapur); September 1917 (Alnavar, Bidi); September 1918 (Khandala); September 20, 1895 (Khandala); September 26, 1895 (Khandala to Talegaon); October 1919 (Hattikeri); October 26, 1910 (Hangal).

*Field notes*: A plant of the marshes and open grassland where there is plenty of water in the soil during the monsoon. The stems are comparatively weak, always drooping when long—single or in small clusters.



*F. B. Das, del.*

*Pycreus malabaricus* C. B. Clarke.

A good species. Comparatively easy to distinguish both in the field and the herbarium.

Flourishes throughout the year in marshes only, otherwise a monsoon species.

Spikelets chocolate brown or dark reddish brown becoming a brighter red when dry. Stems 3-gonous.

*Distribution*: Sind, Konkan, W. Ghats, Deccan, S. M. Country, N. Kanara, throughout India, Ceylon.—Warm parts of the Old World.

5. **Pycreus puncticulatus** C. B. Clarke in Hook. f. F.B.I. vi, 593.—*P. Baccha* Nees in Linnaea ix (1835) 283.—*Cyperus puncticulatus* Vahl Enum. ii (1806) 348; Cke. ii, 858.

*Description*: Cke. l.c.

*Locality*: *Konkan*: (Dalzell ex Cooke).—*W. Ghats*: Londa (Cooke).—We have seen no specimen from the Presidency.

*Distribution*: W. Peninsula.—Ceylon, China.

6. **Pycreus albomarginatus** Nees in Mart. Fl. Brass. ii, pt. i (1842) 9.—*Cyperus albomarginatus* Mart. & Schrad. ex Nees in Fl. Bras. ii, pt. i (1842) 9; Cke. ii, 858.—*C. Hochstetteri* Nees ex Krauss in Flora xxviii (1845) 755, *in nota*.

*Description*: Cke. l.c. (under *Cyperus*).

*Locality*: *W. Ghats*: Igatpuri (McCann 2377 ! 2378 !); Khandala, St. Mary's Villa grounds (McCann C103 !); Castle Rock (Gammie !); Londa (Gammie !, Woodrow ex Cooke).—*Konkan*: (Stocks ex Cooke); N. & S. Konkan (Law ex Cooke); Bombay (ex Herb. Hook. in Herb. Kew. ex Cooke); Budlapur (Herb. St. X. C. 3150 !); Vetora (Sabnis 33763 !); near Budlapur (Woodrow !, H.E.B.B. !); Karjat to Palasdari (H.E.B.B. !); Borivli to Kanari Caves, margin of a tank (McCann 1107 ! 1108 ! 1099 !); Varol Tank, Bhivandi, near Kalyan (McCann 1711 !).—*S. M. Country*: Alnavar, 2,000 ft., rainfall 40 in. (Sedgwick 3054 !); Kasgod (Sedgwick 2974 !).—*N. Kanara*: Sejwad, near Karwar, in a tank (Sedgwick 6722 !); Yellapur, 1,500 ft., rainfall 100 in. (Sedgwick 6583 !); Karwar (Hallberg & McCann C104 !); Sampkhand (Hallberg & McCann C105 !); Haliyal (Talbot !).

*Flowering & fruiting*: September 1917 (Kasgod, Alnavar); September 1918 (Khandala); September 15, 1929 (Borivli to Kanari Caves); September 20, 1888 (Haliyal); September 27, 1895 (near Budlapur); October 1899 (Londa); October 1902 (Castle Rock); October 1917 (Igatpuri); October 1919 (Sampkhand, Karwar, Sejwad).

*Field notes*: A good species. Purely a monsoon species commencing to flower about the last week in August. Dies down completely after the rains.

A plant of 'dry' ground and in the shallow water of tanks, growing among other plants. When on 'dry' ground a much shorter and robust plant, when in water grows taller with larger umbels. Umbels generally very large but we have seen specimens with the inflorescence reduced to a few spikes. Umbel 50 cm. across.

Stem terete below, near the base, 3-gonous with rounded angles above. Leaves as long as the stem or slightly longer. Umbel-rays 14, 23.8 cm. long, secondary rays 5.2 cm. Bracts reaching 89 cm. by 12 mm.

A robust plant with a large spreading umbel readily distinguished in the field when mature, but very young specimens are very often difficult to place.

Spikelets brown, frequently becoming reddish in the herbarium.

The largest and most characteristic of the *Pycreus* species in the Presidency. The species *puncticulatus* approaches it [from the single specimen seen in the Calc. Herb. (not from the Presidency) ] but we have seen no specimens of this plant from our area.

*Distribution*: Konkan, W. Ghats, S. M. Country, N. Kanara, Quilon, Rangoon.—Ethiopia, N. Australia.

7. **Pycreus globosus** Reichb. Fl. Germ. Excurs. $140^{10}$ (1830-32).—*P. capillaris* Nees in Linnaea ix (1834) 283.—*Cyperus globosus* All. Auct. Fl. Pedem. (1789) 49; Cke. ii, 857.—*C. nilagiricus* Hochst. ex Steud. Syn. Pl. Glum. ii, 2.—*P. capillaris* var. *nilagiricus* C. B. Cl. in Journ. Linn. Soc. xxi, 49.—*P. globosus* Reichb. var. *nilagirica* C. B. Cl. in Durand & Schinz Consp. Fl. Afri. v, 537.

*Description*: Cke. l.c. (under *Cyperus*).

Specimen No. 5576 has spikelets which measure 36 mm. against Cooke's measurements.

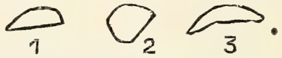
C. B. Clarke (Fl. Trop. Africa viii, 300) says: 'The species *nilagiricus* was originally grounded on the black-chestnut colour, while my var. *nilagirica* includes all the narrow spikeleted heads whatever the colour'. We quite agree with Cooke (ii, 858) when he says that this character is not a reliable one and we therefore drop the var. *nilagirica*.

Parker (Flora of the Upper Gangetic Plain, vol. iii, pt. iii, 338) holds the same view with regard to var. *strictus* C. B. Clarke, as it appears to be connected with the type by all grades of intermediates.

Haines (Bot. Bihar & Orissa, 904) made a *nov. comb.* of *P. globosus*. He was evidently not aware of Reichenbach having been the first to use that name.

*Locality*: *Gujarat*: Nalas near the Bokh, Prantij (Sedgwick 256 !).—*Khandesh*: Amalner, Bori River (Blatter & Hallberg 1970 !); Bori River (Blatter & Hallberg 1990 !); Tapti River (Blatter & Hallberg 3026 !); Bor, Tapti River (Blatter & Hallberg 3012 ! 3032 !); Bhusawal, Tapti River (Blatter & Hallberg 3087 !); Dhulia (Chibber !); Noti tank (Chibber !).—*W. Ghats*: Khandala (Blatter & McCann 3181 !); Purandhar (Blatter & McCann 5575 ! 5576 ! 5587 !); Mahableshwar (Chibber !, Woodrow ex Cooke); Panchgani, below 3rd Tableland (McCann 3224 !).—*Deccan*: (Dalzell & Gibson ex Cooke); Nasik (Blatter & Hallberg 2822 !, Kuntze); Gungapur, Nasik (Blatter & Hallberg 2831 !); Poona (Cooke, Belkar !, Jacquemont 409 ex Cooke), riverside (Bhide 3 ! 22 !); Mangri, near Poona (Gammie 15341 !); Ganeshkhind Gardens (Garade 431 !); Soos, 8 miles N.-W. of Poona (Babajee !, Bhiva ex Cooke); Hura (Dalzell ex Clarke).—*Konkan*: (Stocks, Law ex Cooke); Bhandup (Blatter & McCann 2415 !); near Kalyan (H.E.B.B. !).—*S. M. Country*: Havasbhavi, fields, 1,800 ft., rainfall 35 in. (Sedgwick 2095 !);Bagalkot (Patwardhan !).—*N. Kanara*: Yellapur, rice fields (Talbot 2950 !).

*Flowering & fruiting*: January 25, 1925 (Sangli); February 11, 1904 (Mangri); March 1917 (Khandala); March 17, 1908 (Mahableshwar); March 24, 1929 (E. of Tulsi Lake); March 31, 1929 (Khandala); April 17, 1906 (Bagalkot); May 8 and 9, 1902 (Poona); June 1917 (Bhandup); June 13, 1902 (Ganeshkhind); August 17, 1902 (Mangri); August 22, 1929 (Sivapur); August 28, 1929 (Panchgani); September 1906 (Bawada); September 1917 (Gangapur, Nasik); September 1919 (Khandala); September 20, 1895 (Poona); September 28, 1884 (Yellapur); September 29, 1895 (Kalyan); October 1914 (Sonasan); October 24, 1929 (Gorair Bridge); October 29, 1890 (Soos); November 12, 1929 (Panchgani); December 1916 (Bhusawal, Bor, Amalner, Tapti River); December 1917 (Purandhar); December 27, 1907 (Dhulia).

*Field notes*: A most variable species. A plant generally found in marshes, river-beds and about springs. If there is sufficient moisture it will flourish all the year round. The specimens from the northern part of the Presidency (Gujarat) are generally much larger and with paler spikelets than those from the southern part of the Presidency (Sedgwick also remarks on the point of colouring). The stem may have different forms in section .

The Panchgani and Mahableshwar specimens are remarkable for their long bracts; margin serrulate.

The inflorescence rapidly breaks up when mature.

This plant is so variable, that it is difficult to define the specific limits.

Saxton and Sedgwick found this plant in Gujarat in close association with *Fuirena glomerata* Lam.

*Distribution*: Throughout India, Ceylon.—Most temperate and tropical regions of the Old World.

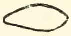
5. **Pycreus odoratus** Urban Symb. Antill. ii, 164.—*P. polystachyus* Beauv. Fl. Owar. ii, 48, t. 86, fig. 2.—*Cyperus odoratus* Linn. Sp. Pl. (1753) 46; Cke. ii, 859.—*C. polystachyos* Rottb. Descr. et Ic. (1773) 39, t. 11, fig. 1.—*C. ferrugineus* Poir. in Lam. Encycl. vii, 261.—*Pycreus ferrugineus* C. B. Clarke in Hook. f. F.B.I. vi, 593.

*Description*: Cke. l.c. (under *Cyperus*).

*Locality*: *Sind*: (Pinwill ex Cooke).—*Cutch*: Near the coast (Blatter ex

J.B.N.H.S.).—*Gujarat*: Surat (Woodrow ex Cooke).—*W. Ghats*: Dudhsagar Falls (McCann C187 ! C188 !); Castle Rock, 1,700 ft., rainfall 200 in. (Herb. Sedgwick & Bell 5680 !).—*Konkan*: Sion, in a marsh near railway station (McCann 967 ! 967a ! 967b !); Kurla, marshes (McCann !); Vickroli (McCann !); Malvan (Woodrow ex Cooke).—*S. M. Country*: Devarayi, 1,800 ft., rainfall 90 in. (Sedgwick 4042 !); Siddhapur Taluka (Talbot in Calc. Herb. !).—*N. Kanara*: Karwar, near the sea (Sedgwick 5081 !), salt marshes (Sedgwick 5102 !), on Light-House Island (Bell 7732 !), by a pool, Hattikeri (Herb. Sedgwick & Bell 6766 !, Hallberg & McCann C101 ! C180 !), on sandy soil (Talbot 1255 !).

*Flowering & fruiting*: March 1919 (Castle Rock, Dudhsagar); June 1918 (Devarayi); June 25, 1885 (Karwar); August 1918 (Sulgeri); August 28, 1929 (Sion); October 1919 (Karwar, Hattikeri); December 1918 (Karwar).

*Field notes*: A densely tufted species growing in marshes. Roots strongly aromatic. Inflorescence pale brown, becoming darker and turning reddish when drying. Stems 3-gonous becoming bilaterally compressed above  under the umbel. Dies down after the monsoons or the culms remain without the inflorescence. Quite common around Sion and Kurla during the monsoon. Commences flowering in early July. The inflorescence is very variable.

In Sion we have found it growing together with *Fimbristylis polytrichoides*.

*Uses*: A good sand-binding species (Prain).

*Distribution*: Throughout India near the coast.—All warm, especially maritime regions.

9. **Pycreus hyalinus** Dom. in Biblioth. Bot. lxxxv (1916) 417.—*Cyperus hyalinus* Vahl Enum. ii (1806) 329; Cke. ii, 857.—*C. pumilus* Nees in Wight Contrib. (1834) 74 (*non* Linn.).—*Pycreus pumilus* Nees in Linnaea ix (1835) 283; C. B. Clarke in Hook. f. F.B.I. vi, 591.

*Description*: Cke. l.c.

*Locality*: Without locality (Dr. Leith 25 ex Cooke).—*Konkan*: Sion (H.E.B.B. !, Blatter & McCann 3151 !).

*Flowering & fruiting*: September 1917 (Sion).

*Distribution*: Konkan, about Madras City, Satiamangulam, Coimbatore District, Pulney Hills at 6,000 ft.—Ceylon, Timor.

Apparently an extremely rare species. McCann has repeatedly visited the stated locality in recent years to obtain further information about this species, but has not succeeded in finding a single specimen.

Sedgwick, Rec. B. Sur. of Ind. vol. vi, p. 304—'Plants of Northern Gujarat', mentions this species as occurring in Gujarat. Evidently this is a mistake for *P. pumilus* Dom. as this species has never been found in the Presidency outside Sion, and, in his Cyperaceae of the Bom. Pres. in the Journ. Bom. Nat. Hist. Soc., Sedgwick remarks under the species 'Very rare. Apparently only from Sion, Bombay.' This paper was published subsequent to the 'Plants of Northern Gujarat' though in the same year. *P. hyalinus* does not occur in Gujarat, but *P. pumilus* is extremely common.

10. **Pycreus pumilus** Dom. in Biblioth. Bot. lxxxv (1916) 417.—*Cyperus pumilus* Linn. Amoen. Acad. iv (1788) 302; Cke. ii, 857.—*C. nitens* Retz. Obs. v (1789) 13 ?.—*C. pulvinatus* Nees et Meyen in Wight Contrib. (1834) 74.—*Pycreus pulvinatus* Nees in Linnaea ix (1834) 283.—*P. nitens* Nees l.c.; C. B. Clarke in Hook. f. F.B.I. vi, 591.—*C. pygmaeus* Retz. Obs. iv, 9—*C. pusillus* Vahl Enum. ii, 303.

*Description*: Cke. ii, 857 (under *Cyperus*).—Bracts reach 17.4 cm.

| | Cooke's measurements. | Our measurements. |
|---|---|---|
| Bracts: | up to 4½ in. | up to 17 cm. |
| Spikelets: | 20-50-flowered | 9 upwards. |

All the Floras state that this species has 1-2 stamens (usually one). All the specimens examined of this species have 3 stamens. One anther is on a long filament, the other two filaments are short (one shorter than the other) and close to the nut. The long filament is the only one which shows itself clearly and a careful dissection is needed to disclose the other two. These two are displaced early by the developing nut leaving the long solitary stamen.

*Locality*: *Sind*: (Pinwill ex Cooke).—*Gujarat*: Godhra (H.E.B.B. !).—*W. Ghats*: Khandala (McCann 3184 ! C119 ! C120 !, Gammie 15387 !), in a marsh near the station (McCann 351 !); Lonavla (Blatter, Hallberg & McCann 3148 !, Woodrow !).—*Deccan*: Bhusi, Mawal, Poona (Supt. of Lonavla Farm 9 !); Mawal (Woodrow ex Cooke); between Nadsur and Pali, in rice fields (Gammie 16047 !).—*Konkan*: (Stocks, Law ex Cooke); Bombay Isl. (Herb. St. X. C. 2799 !), Dhobi Talao (Blatter & McCann 3092 !); Pen (Blatter, Hallberg & McCann 3227 !); Mulland, open ground (McCann 897 ! 903 !); Sion Hill (McCann 936 !); Borivli to Kanari Caves (McCann 1161 !).—*S. M. Country*: Alnavar, 2,000 ft., rainfall 40 in. (Sedgwick 2938 !).—*N. Kanara*: Hattikeri to Karwar, hillside, in rock crevices (Sedgwick & Bell 6770 !); Karwar, growing on old cart tracks (Talbot 1513 !); Dandeli, sand of river, 1,800 ft., rainfall 100 in. (Bell 4225 !); Yellapur (Talbot 983 !); Sanikalta, sea shore (Chibber !); Kanara (Woodrow ex Cooke).

*Flowering & fruiting*: February 1917 (Pen); March 1917 (Khandala); March 29, 1929 (Khandala); April 15, 1929 (Khandala); May 1917 (Khandala); August 1895 (Karwar); August 1918 (Dandeli); August 11, 1929 (Mulland); August 25, 1929 (Sion); September (Lonavla); September 1892 (Godhra); September 1914 (Wadaj); September 1919 (Khandala); September 1917 (Bombay, Alnavar); September 10, 1883 (Yellapur); September 15, 1929 (Borivli to Kanari Caves); September 20, 1902 (Khandala); October 1914 (Sonasan); October 1919 (Yellapur, Hattikeri); November 1, 1910 (Sanikalta); November 12, 1907 (Bhusi); December 1916 (Bor); December 9, 1902 (between Nadsur and Pali).

*Field notes*: A monsoon and marsh species; during the dry weather usually found in soft sticky soil. Forming small tufts of a number of plants growing together in one mass.

In plants growing in marshes during the hot weather we have noticed the entire plant, including the inflorescence, quite green, but in monsoon specimens outside true marshes we have noticed the inflorescence straw coloured. In the northern parts of the Presidency this species is common in the sandy and stony beds of streams.

A species easily overlooked during the hot weather on account of the uniform green colouring. The best specimens are obtained in soft mud during the monsoon.

With the exception of the marsh examples which flower the year round, this species commences to flower in early August.

We cannot agree with Sedgwick that this plant is the commonest plant on sandy places as it is equally common in thick sticky soil in marshes and even in water. At Khandala particularly, it is extremely common in the marsh between the railway station and the Parsi Sanatorium. Here it is quite green —the whole plant—and is easily overlooked for a *Cyperus* with only leaves, particularly in its dwarf state. In the same marsh it is to be found right through the dry weather. Specimens taken on sandy soil were certainly taller than those from the marsh. Where the marsh specimens lost in size they made up in roots, as the roots in these specimens were much more elaborate than in those obtained in sandy situations.

*Distribution*: Throughout India.—Ceylon, Malaya, China, tropical Africa and Australia.

### 3. JUNCELLUS C. B. Clarke.

Stems erect, leafy only near the base. Leaves rarely reduced to sheaths; sheaths not inflated. Inflorescence umbellate or capitate. Spikelets compressed; rhachilla persistent. Glumes distichous, concave, the 2 lowest empty, the uppermost 1-3 sterile or empty, the intermediate bisexual. Stamens 3 or 2. Style 2-fid. Nut plano-convex, more or less compressed at right angles to the rhachilla.—Species about 20.—In all warm climates.

Of the three *Juncelli* that occur in the Presidency all are very distinct from one another and are easily recognized. *J. alopecuroides* Clarke is perhaps the largest of the three and is liable to be confused with a *Cyperus*, but the rhachilla and nut coupled with the 2-fid style separate it at once from that genus.

| | |
|---|---|
| 1. A tall stout herb. Spikelets in a large compound umbel ... ... ... | 1. *J. alopecuroides.* |
| 2. A dwarf herb. Spikelets close-packed in a small terminal head ... ... | 2. *J. Michelianus.* |
| 3. A glacuous herb, about 30 cm. high. Spikelets in a small, apparently lateral head ... | 3. *J. laevigatus.* |

1. **Juncellus alopecuroides** C. B. Clarke in Hook. f. F.B.I. vi (1893) 595.—*Cyperus alopecuroides* Rottb. Descr. *et* Ic. (1773) 38, t. 8, fig. 4; Cke. ii, 860.

*Description*: Cke. l.c.

Rhizome stout, clothed with black, linear or linear-lanceolate scales, scales striate (dry specimen). Stem up to 140 cm. by 13.5 mm. (at base), enclosed in thick spongy sheaths, striate. Leaves 64 cm. (incomplete) by 15 mm.

Rays up to 7, up to 17.8 cm. (the longest) terminated by about 6 spikelets; secondary rays 4.3 cm. Bracts exceeding 45 cm. by 12 mm., margins scabrous, 5 in number; bracteoles (secondary) at base of each primary ray 45 by 3 mm. at base.

Mr. Bhide remarks 'Style occasionally 3-fid'. Sedgwick also says that the style is sometimes 2-fid and sometimes 3-fid. In specimens examined we have found the style 2-fid and ocasionally 3-fid.

Specimens taken at Shivneri Fort in March are golden in colour, while those taken at other times are a pinkish grey.

Talbot's specimen No. 1064 was determined as *Cyperus exaltatus*, but this specimen is undoubtedly a *Juncellus*. The specimen from Devikope is a very fine example.

*Locality*: *Sind*: (Stocks ex Cooke); Kullan Kote Lake (Blatter & McCann D711 !); Lake near Tatta (Blatter & McCann D712 !).—*Gujarat*: In standing and running water (ex Saxton & Sedgwick); marshes near Prantij (Sedgwick 283 !); Ahmedabad, Watrak River, rainfall 32 in. (Sedgwick 1061 !); Godhra (Chibber 611 !); Panch Mahals (Woodrow ex Cooke).—*Deccan*: (Woodrow ex Cooke); Patas (Bhide !); Shivneri Fort near Junnar, growing in tanks (Paranjype, several sheets !); between Ellora and Poona (Jacquemont 279 ex Cooke). —*Konkan*: Bombay (Jacquemont 438 ex Cooke).—*S. M. Country*: Alnavar, 2,000 ft., rainfall 35 in. (Sedgwick 2290 !); Devikope (Talbot 1064 !).—*N. Kanara*: Yellapur (Talbot !).

*Flowering & fruiting*: January 6, 1903 (Patas); February 1917 (Alnavar); March 22, 1911 (Shivneri Fort); May 10, 1912 (Shivneri Fort); August 1914 (near Prantij); August 1916 (Watrak River); September 10, 1911 (Shivneri Fort); November 5, 1884 (Yellapur); December 5, 1907 (Godhra).

*Distribution*: Throughout India.—Ceylon, Tropical and N. Africa, Mascarene Islands, Malaya, Queensland, Guadeloupe.

2. **Juncellus Michelianus** (Linn.) Blatter & McCann, *comb. nov.*—*Scirpus Michelianus* Linn. Sp. Pl. (1753) 76.—*Isolepis Micheliana* Roem. & Schult. Syst. ii, 114.—*Dichostylis Micheliana* Nees in Wight Contrib. 94.—*Cyperus pygmaeus* Rottb. Descr. *et* Ic. (1773) 20, t. 14, fig. 5; Cke. ii, 859.—*Cyperus pygmaeus* var. β Boeck. in Linnaea xxxv (1868) 494.—*Juncellus pygmaeus* C. B. Clarke in Hook. f. F.B.I. vi (1893) 596.

*Description*: Cke. l.c. (under *C. pygmaeus*).

The following is a remark by Clarke on a sheet of Kurz (Herb. Sulp. Kurz.): 'Boeckeler has sunk *Isolepis micheliana* into *Cyperus pygmaeus* considering that *Cyperus pygmaeus* has sometimes its axis twisted and the scales hence not bifarious. But besides this difference *Isolepis micheliana* has the glumes imbricate on all sides (of) the axis, the achene is really quite different. In *Isolepis micheliana* the achene has a translucent margin and under the microscope one achene of *Isolepis micheliana* can easily be picked out of a heap of achenes of *Cyperus pygmaeus*.' C. B. Clarke, May 1883.

When working out the *Cyperaceae* of the Bombay Pres. McCann independently arrived at the same conclusion as Boeckeler and remarked the following in his MS.: "I am of opinion that Boeckeler was right in uniting this species (*Juncellus pygmaeus*) with *Scirpus Michelianus*. I find no difference between the 'two'. The only distinguishing point according to Clarke is the 'imbricate' spikelets (glumes) in *S. Michelianus* and distichous sp. in *J. pygmaeus*. I have examined all the material available from the Presidency. In the same head are to be found the distichous as well as the 'imbricate' glumes. In all cases the lower portion of the spikelet is distichous while the upper portion is imbricate only. 'This is possibly due to the close-set glumes (spikelets) in a dense head causing the rhachilla to twist thus giving the appearance of the glumes being imbricately set on it.' After writing this remark I was able to examine the material at Calcutta all of which was named by C. B. Clarke. I compared the material of both species referred to and could not distinguish one from the other. Even the remarks regarding the nut (as above) do not agree with the reality. I examined several nuts of both 'species' on the same slide and could not distinguish them. I finally mixed them up and not even then could separate one from the other.'' C. McCann, March 17, 1930.

In the Journ. Bom. Nat. Hist. Soc. vol. xix, p. 162 (Flora of Cutch) there is mentioned in the list *Cyperus pygmaeus* C. B. Clarke. This we take to be this species, viz. *J. pygmaeus* as the authority is evidently wrongly quoted—there is no *C. pygmaeus* named by C. B. Clarke. Clarke transferred *C. pygmaeus* Rottb. to *J. pygmaeus.*

The specimens from Kanheri measure 40 cm. (Cf. Cooke). Judging from the unusual length, these plants must have been growing among other vegetation and in their effort to get to the light the stems have become elongated; the stems are comparatively weak considering the usual habit of the plant.

*Locality*: Without locality (Dalzell H.E.B.B. !).—*Cutch*: Blatter (ex Journ. Bom. Nat. Hist. Soc.).—*Gujarat*: Kabir Vad (Chibber 765 !, Gammie !); Nadiad (Chibber 248 !); Surat (Woodrow ex Cooke, Gammie 16443 !); Ahmedabad, dry edges of the Chandola tank (Sedgwick !); Sabarmati River, bank (Saxton 2753 !).—*Khandesh*: Bhusawal, Tapti bank (McCann 3034 !, Gammie); Taner, Tapti bank (Blatter & Hallberg 5174 !); Bor, island, Tapti River (Blatter & Hallberg 1862 ! 1925 !); Bori, island, Tapti River (Blatter & Hallberg C97 !).—*W. Ghats*: Khandala (Blatter & McCann 3163 ! 3173 ! 3174 ! 3186 !), in a marsh near station (McCann 379 ! 393 ! 408 ! 409 !).—*Deccan*: Bairawadi, near Purandhar (Blatter & McCann 5611 !); Sangli, river bank (Blatter C95 ! C96 !); in the Katraj tank (Gammie 15226 !); Sholapur, Sideshwar tank (H.E.B.B. !); Poona (Woodrow ex Cooke).—*Konkan*: (Law ex Cooke); Pen (Blatter, Hallberg & McCann 3234 ! 3249 !); Bhandup (Blatter & McCann 2433 !); Uran, Bombay Harbour (Hallberg & McCann 2736 !); Kanheri, Thana Dist. (Gammie 16271 !); Sion (Blatter & McCann 2728 !).—*S. M. Country*: Nigadi, rice fields (Dharwar Dist.), 2,000 ft., rainfall 35 in. (Sedgwick 5710 !); W. of Dharwar, dried rice fields, 2,000 ft., 35 in. (Sedgwick 2207 !); Bagalkot, Bijapur Dist. (H.E.B.B. !).—*N. Kanara*: Nincholi (label illegible, eaten by insects) on river bank (Talbot 946 !).

*Flowering & fruiting*: January 1917 (Uran); January 21, 1925 (Sangli); February 1917 (W. of Dharwar); February 1917 (Pen); March 1917 (Khandala); March 1919 (Nigadi); April 1929 (Khandala); April 4, 1884 (Nincholi); April 12, 1906 (Sholapur); April 17, 1906 (Bagalkot); May 1914 (Ahmedabad); May 1917 (Khandala); May 8, 1903 (Kanheri); May 28, 1902 (Katraj); June 1917 (Bhandup); October 29, 1903 (Surat); November 25, 1907 (Nadiad); December 1916 (Bor, Bhusawal); December 1917 (Bairawadi); December 10, 1907 (Kabir Vad); December 17, 1921 (Ahmedabad); December 20, 1904 (Kabir Vad); December 21, 1902 (Bhusawal); December 30, 1916 (Taner).

*Field notes*: A plant generally to be met with near water or damp earth at any time of the year. Boggy or sandy soil is immaterial, but better specimens are certainly developed on sandy situations, particularly on the banks of tanks and streams. Where the specimens inhabiting marshes lose in size, this is made up for by way of roots. On sand the roots are short and few in number compared with those growing in marshes.

'When growing on edges of tanks it flowers when exposed by the subsidence of the water, and right on through the dry season.' (Saxton & Sedgwick).

*Distribution*: More or less throughout India.—Ceylon, Tropical and N. Africa, Orient, China, Amurland, Malaya and Australia.

3. **Juncellus laevigatus** C. B. Clarke in Hook. f. F.B.I. vi (1893) 596.—*J. laevigatus* var. *junciformis* (Desf.) C. B. Clarke l.c. 597.—*Cyperus junciformis* Desf. Fl. Atlant. i, 42, t. 7, fig. 1.—*C. laevigatus* Linn. Mant. (1771) 179; Cke. ii, 860.

*Description*: Cke. l.c.

In the Herbarium of the Imperial Forest Institute, Dehra Dun, there is a sheet of this species, collected by Dalzell without locality. The whole sheet comprises a single specimen with a long creeping stolon on which both the variety, var. *junciformis*, and the type are represented. The part representing the species is very large—38 cm. with a bunch of spikelets 2 cm. from the top, all of a pale straw colour, or dirty white. There are 13 spikelets, the longest of which is 14 mm. and of about 40 flowers. The sheath ascends the culm for about 10 cm., the latter is 6 mm. thick (but it may not have the diameter when fresh). The variety is represented by single and tufted culms along the stolon. The stems are almost 20 cm. high, thin, with the sheath in some cases reaching almost half way up. The spikes are short and few-flowered, a dark reddish brown in colour. They are from 1-4 in number and about 16-flowered. The apparent continuation of the culm is a little longer in these cases. All the spikelets of the culm representing the variety are all in flower, while those on the culm representing the species are in fruit.

This is very curious and will perhaps enable us to throw some light on other such cases. Under these circumstances the variety must necessarily fall and the characters be added to the description of the species.

We think that the large culm representing the species is a late culm of the wet season form and that those representing the variety are the dry season form. This view is not altogether wrong as the 'type culm' is in fruit and the variety culms are in early flower.

*Locality*: Without locality (Dalzell, H.I.F.I. !).—*Sind*: (Stocks 751 ex Cooke, Pinwill ex Cooke).—*Kathiawar*: (Woodrow ex Cooke); Ghogho (Herb. Col. of Sc. Poona now in Herb. Calc. !).—*Gujarat*: Ahmedabad (Rep. on Econ. Prod. to Govt. of India 15610 !); nala near Wadaj, Ahmedabad (Sedgwick 300 !, Saxton 2831 !); Kharaghoda (Saxton !); edges of the Bokh, Prantij (Sedgwick 257 !); sandy bed of stream under Gorair Bridge, Chitrasani to Sarotra (McCann 1365 ! 1365a ! 1465b ! 1365c !).—*Khandesh*: Dhulia (Chibber !).—*Deccan*: Nira Canal, Poona Dist. (Chibber !); Happy Valley, Ahmednagar Dist. (Chibber !).—*Konkan*: Bombay, salt marshes (Herb. St. X. C. 3144 !, Woodrow !); salt marshes behind Goods Yard, Bandra (Vakil C127 !).—*S. M. Country*: Hubli, 2,000 ft., rainfall 30 in. (Sedgwick 5081 !); Yelvigi, Dharwar Dist., 1,800 ft., rainfall 25 in. (Sedgwick 1936 !).

*Flowering & fruiting*: January 1919 (Hubli); February 1919 (Bandra); February 2, 1894 (Ghogho); March 14, 1908 (Nira Canal); August 1914 (Prantij); September 1914 (Wadaj); October 11, 1914 (Kharaghoda); October 24, 1929 (Gorair Bridge); December 1916 (Yelvigi); December 25, 1907 (Happy Valley); December 27, 1907 (Dhulia).

*Field notes*: A plant of sandy river beds and marsh alike with long far reaching stolons with the culms at intervals, solitary, or many together. Roots appearing along the underside of the stolon. Stolon yellowish to light yellow-brown.

Culms very obtusely 3-gonous, almost terete, a polished bright green.

Spikelets pale green, turning straw coloured (no brown dots in fresh specimens). Rhachilla green (no brown spots). Glumes with 3 distinct green nerves, sides hyaline, margins decurrent into the rhachilla. Stigmas occasionally 3. Anthers yellow with bright red acute tips. Nut green at first, turning straw coloured.

Saxton and Sedgwick found this species in close association with *Paspalum distichum* Linn. and *Panicum punctatum* Burm.

See R. Ranade, *Cyperus laevigatus* as a soil indicator. In Proc. 10th Ind. Sc. Congress (1924) 190.

*Distribution*: Kashmir, Punjab, Upper Gangetic Plain.—In all warm and temperate regions.

(*To be continued*).

# SOME BEAUTIFUL INDIAN TREES.

BY

E. BLATTER, S.J., Ph.D., F.L.S. and W. S. MILLARD, F.Z.S.

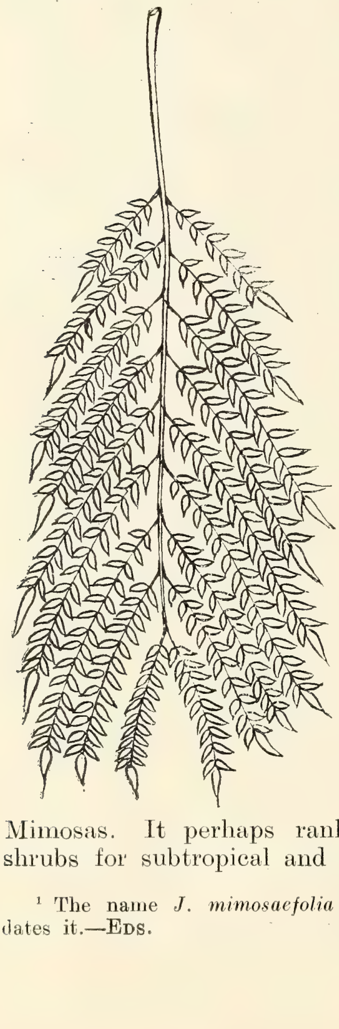
## PART XIV.

(*With one coloured plate, one black-and-white plate and two text-figures*).

(*Continued from page* 780 *of volume* xxxvi).

### Plate XXII. THE MIMOSA-LEAFED JACARANDA.

*Popular names*: Jacaranda (Brazilian); Mimosa-leafed Jacaranda.



***Jacaranda mimosaefolia** D. Don in Bot. Reg. (1822) t. 631.—*Jacaranda ovalifolia* R. Br. in Bot. Mag. (1822) t. 2327.—Belongs to the *Bignoniaceae*.

*Description*: A tree, 50 ft. and more. The foliage is as finely cut as a fern, symmetrical and elegant. The leaves are opposite, distant, each one with 16 or more pairs of pinnae, each pinna having 14-24 pairs of leaflets; leaflets oblong-rhomboid,[1] $\frac{1}{5}$–$\frac{1}{3}$ in. long, the end-one larger. The plant bears loose, pyramidal panicles, 8 in. high, of 40-90 blue flowers, each 2 in. long and 1½ in. wide, which have a long, bent, swelling tube and the 2 lobes of 1 lip smaller than the 3 other lobes. Calyx small, 5-toothed (or in other words: Corolla 2 in. long, the tube slender and curved below, inflated above, the limb 2-lipped, one lip 2-lobed, the other 3-lobed). Perfect stamens 4, 2 long and 2 short; barren stamen (staminode) about as long as the stamens, club-shaped at the tip. Fruit an oblong, ovate or broad dehiscent capsule.

A very beautiful tree with foliage resembling that of the Albizzias or Mimosas. It perhaps ranks among the best flowering trees or shrubs for subtropical and tropical regions.

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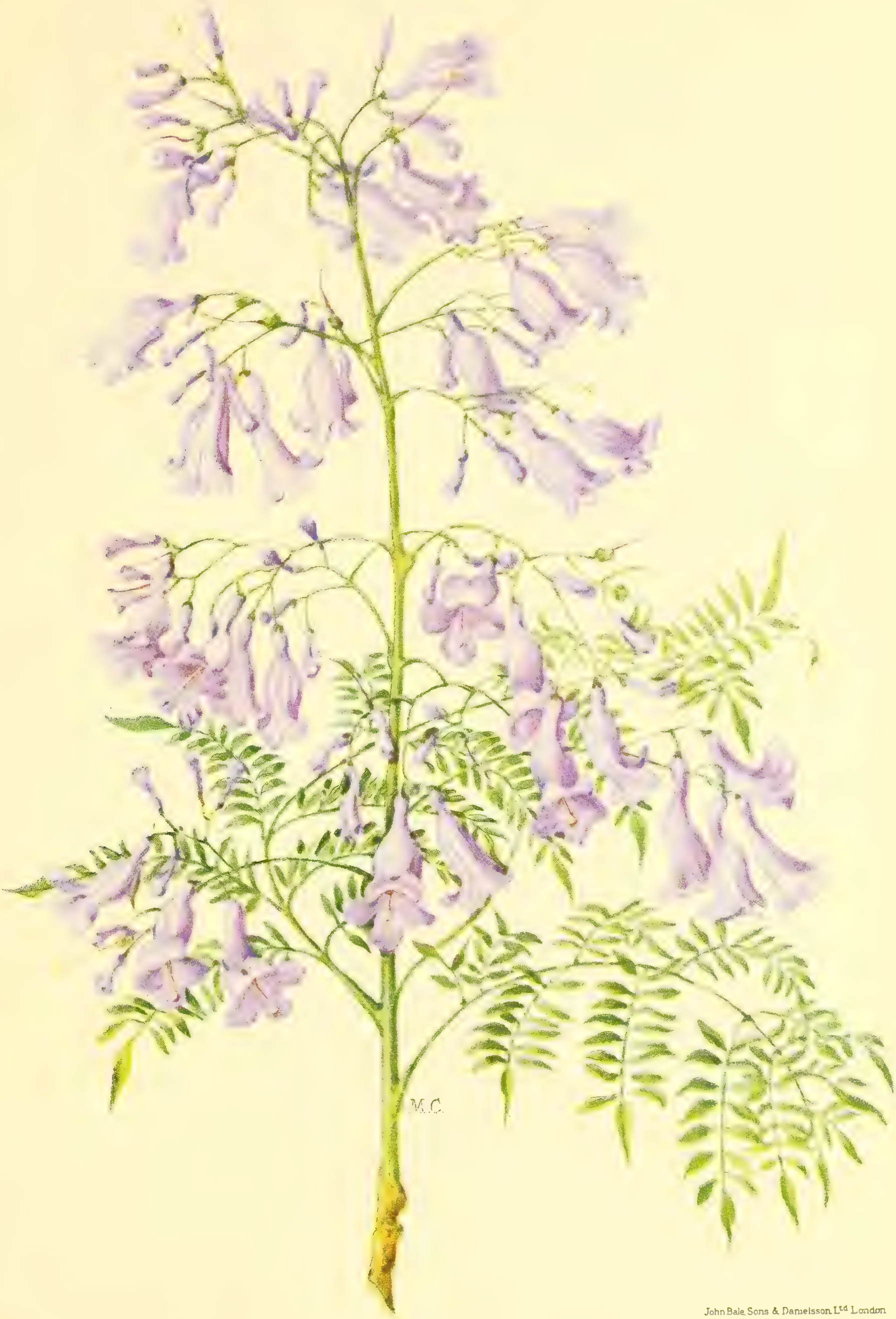
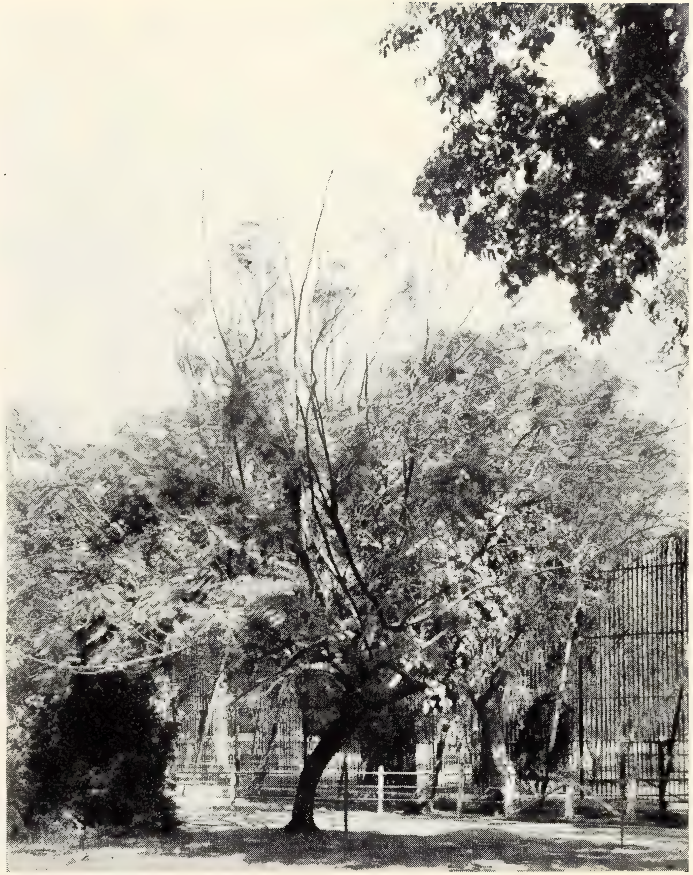
[1] The name *J. mimosaefolia* must give place to *J. ovalifolia*, which antedates it.—EDS.

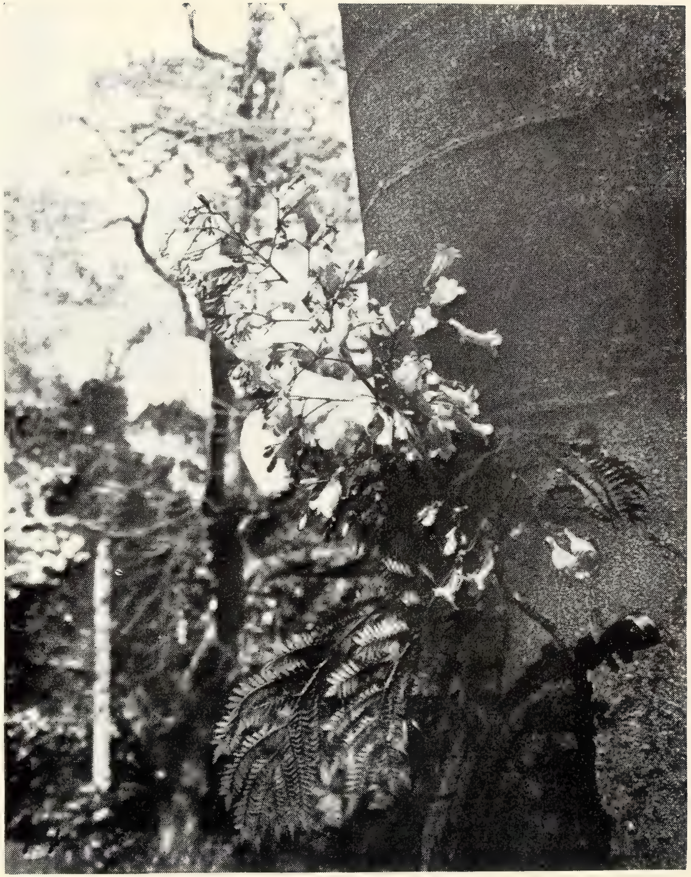


John Bale, Sons & Danielsson Ltd London

The Mimosa-leafed Jacaranda.
Jacaranda mimosaefolia, D. Don.
(about ½ nat. size)



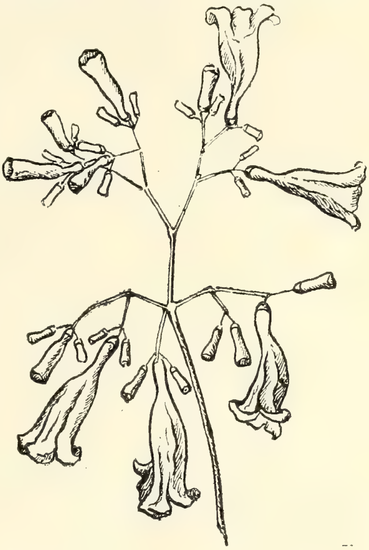
The Mimosa-leafed Jacaranda,
(*Jacaranda mimosaefolia*, D. Don.).



A spray of flowers of the Mimosa-leafed Jacaranda,
(*Jacaranda mimosaefolia*, D. Don.).

*Photos by C. McCann.*

It is a native of Brazil and of somewhat recent introduction. but now becoming common in gardens.



This tree is not common round Bombay and although it does sometimes flower there, the temperature, or perhaps the sea air does not appear to suit it so well as upcountry. At Pachmarhi, C.P., this tree thrives and flowers splendidly as also in Northern India.

The flowers are violet-blue in colour and the tree flowers in March and also at other times.

*Gardening*: Propagated by cuttings of half-ripened wood. It stands pruning well and can be kept in regular form.

(*To be continued*).

# REPORT ON BURMESE FISHES COLLECTED BY LT-COL. R. W. BURTON FROM THE TRIBUTARY STREAMS OF THE MALI HKA RIVER OF THE MYITKYINA DISTRICT (UPPER BURMA).[1]

BY

DEV DEV MUKERJI,

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(Published with permission of the Director, Zoological Survey of India, Indian Museum, Calcutta).

## PART II.

(*With text-figures* 4 *to* 14).

(*Continued from page* 831, *volume* xxxvi).

### FAMILY: HOMALOPTERIDAE.

**Homaloptera rupicola** (Prashad & Mukerji).

One specimen (36 mm.) from Phungin Hka: '*Nga Hpai*'.

In 1929 Prashad and Mukerji (45) established the genus *Chopraia* to accommodate a very remarkable form of Homalopterid fish, *Chopraia rupicola*, obtained from the rocky streams of Kamaing in the Myitkyina District in Upper Burma. Despite the form being closely related to the genus *Homaloptera*, the fish had to be given a separate generic position in view of certain distinctive features which, till the time of its discovery, had not been ascribed to the genus *Homaloptera*. In his preliminary observations on the classification of the Homalopterid fishes, Hora (36) recognised the genus *Chopraia* as valid and placed it in the sub-family Homalopterinae. Later, in his monographic revision of the Homalopterid fishes he (37) studied them in greater detail and defined the various generic and specific limits. His extensive studies of these fishes, including certain types preserved in different museums in England and in other countries, enabled him rightly to delimit the various genera and species. Of the genera of the family Homalopteridae *Homaloptera* embraces a vast majority of remarkable torrential fishes with similar or diverse adaptive modifications. Hora's collective survey of the whole group of these fishes justified his considerably extending the generic limit of *Homaloptera;* and *Chopraia* should now be considered a synonym of *Homaloptera* as emended by Hora.

The specimen under report agrees almost entirely with the specimens from the type-locality. The interorbital width is nearly equal to the diameter of the eyes. The pectoral fins reach the ventrals which are shorter than the former.

One important feature of *Homaloptera rupicola*, to which attention has so far not been paid, is that the anterior portion of the ventral surface up to the base of the ventral fins is perfectly horizontal and this area is either devoid of scales or the scales are rudimentary. The flat and the naked ventral surface, the *Balitora*-like horizontal position of the pectoral fins, and the general facies of the fish clearly indicate that the fish is an inhabitant of the rapids. The occurrence of the species in the Phungin Hka seems to be rather unusual, and the specimen may have drifted into the river from some of the rocky streams which abound in the neighbourhood.

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[1] Mr. Mukerji's paper was published in two parts because of the need of keeping down the number of pages in the *Journal*. The author was unaware of this arrangement by the Editors; hence several citations to the bibliography which is published at the end of the present part were made in Part I and again references will be found in the present part to plates Nos. I-III which were published with Part I in volume xxxvi.—EDS.

### FAMILY: COBITIDAE.

#### **Botia hymenophysa** (Bleek.).

One specimen (100 mm.) from Sinan Hka: '*Nga-shaba*'.
One specimen (98 mm.) from Tang Hka: '*Nga-pasi*'.

Hora (26) has already discussed at some length the affinities of *Botia berdmorei* of Blyth with *B. hymenophysa* of Bleeker and has considered them conspecific. I have also gone into the question and after a thorough re-examination of the specimens of the two species preserved in the collection of the Indian Museum I agree that *B. berdmorei* is the same as *B. hymenophysa*. The species is extremely variable in regard to the colour pattern, the position of the anal opening and the different body proportions at different stages of its growth and in specimens from different localities.

The two well-preserved specimens from the Mali Hka system have more or less the same colouration as that of *B. berdmorei* figured by Day in his *Fishes of India*. There are from 11 to 12 broad vertical black bands along the sides which pass over the back and join the corresponding ones on the other side. Series of fine black specks and dots are arranged more or less longitudinally all over the body. The dorsal fin is variegated with black bands and blotches. The caudal fin is clouded all over with black dots; it is devoid of any band. A few blackish dots are present on the anal fin also. The rostral barbels are black.

#### **Nemachilus botia** (Ham. Buch.) *sensu stricto*.

(Pl. I, fig. 1; Pl. III, figs. 3 & 4).

Two specimens (102 and 73 mm.) from Tang Hka: '*Sumbrun*'.
Two specimens (88 and 85 mm.) from Tang Hka: '*Sumbrum Chang*'.
One specimen (81 mm.) from Tang Hka: '*Taretu*'.
One specimen (63 mm.) from Phungin Hka: '*Nga Kalang*'.

In his revision of the fishes of the genus *Nemachilus* from Burma, Hora (33) has rightly pointed out that "many of the species of the genus exhibit considerable individual variability"; and so far as I can judge, *N. botia* is perhaps one of the most variable species. It is due chiefly, if not entirely, to the extreme variability of the species that its precise limits have not so far been properly understood and defined, and this has been responsible for considerable misapprehensions. Specimens of *N. botia* have often been erroneously considered to represent a different and distinct species, while others of an allied but distinct species have been referred to *N. botia*. In this connection mention should be made of *N. nebulosa* (Blyth), the short history of which, given below, clearly shows how baffling at times may be the identity of *N. botia*.

In 1860, Blyth (3) described a new Cobitid fish from a single specimen obtained from Darjiling and presented by Dr. Wallich, under the denomination *Botia nebulosa*. He considered the form to be closely allied to "*B. grandis* but with face shorter (as described) and eight cirri not quite so strongly developed". Günther, apparently due to having no access to the type-specimen of *B. nebulosa*, which was deposited and is still preserved in the collection of the Indian Museum, did not include *B. nebulosa* in the synopsis of the various species of the genus *Botia* in his *Catalogue* (19); but he referred to the species in a foot-note (p. 366) without any comments. In 1869, Day (10) examined the type-specimen and published a short account of *B. nebulosa*. He remarked that "a bifid erectile (damaged) suborbital spine" is present. Later, in his *Monograph of the Indian Cyprinidae* he (11) included a short description of the loach without any fresh comments. Both in his *Fishes of India* and in the *Fauna* volume, Day retained the species *B. nebulosa*, and emphasized in a foot-note (p. 606) that the "suborbital spine was damaged in the unique example". The species did not receive further attention till 1922, when in his revision of the fishes of the genus *Botia*, Hora (26) remarked that "On examination I am unable to refer it (*Botia nebulosa*) to the genus *Botia*. I believe that it belongs to *Nemachilus* and in all probability is a male of *N. botius*". Hora gave sufficient reasons for considering *B. nebulosa* to be a *Nemachilus* and pointed out that Day's contention regarding the suborbital spine being damaged in the type-specimen was rather far-fetched, for, "the groove that is present is not sufficiently deep to justify the view that it ever contained a spine. The groove is of the nature of a shallow slit partly covered superiorly by a fold of skin. I have already remarked in a previous paper that such grooves and folds of skin form the secondary sexual characters of certain species of *Nemachilus*". Owing to the paucity of adequate material of *N. botia* for comparison, it was, however, not possible for Hora to go into further details about the systematic position of *B. nebulosa*.

I have thoroughly examined the five specimens under report from the Mali river system and compared them with the specimens of *N. botia* obtained from different places of India and Burma and referred to by Hora in his revision of the genus, and I find that my specimens are referrable to *N. botia*. Recently Messrs. G. E. Shaw and E. O. Shebbeare have collected abundant material of *N. botia* from various streams and rivers of Northern Bengal, and have presented a fine series of them to the Indian Museum. I have examined these specimens and after comparing the type-specimen of *Botia nebulosa* with all the specimens of *N. botia* now at my disposal, I am thoroughly convinced that *B. nebulosa* is not only not a *Botia* but it is an absolute synonym of *N. botia*, of which almost all the adult males are provided with a suborbital groove, and that the presence of a spine in the suborbital groove of the type-specimen of the former was purely conjectural on the part of the earlier authors.

It may not be out of place to mention in this connection that recently Deraniyagala (17) has reported the typical form of *N. botia* under the name *Nemacheilus botia botia* (Ham. Buch.) "from several small streams" in Ceylon. From his description of the fish and the figure it appears that the Ceylonese fish is strikingly allied to *N. botia;* but the fact that the typical form of the species has not so far been known to occur anywhere in Peninsular India, much less in Ceylon, throws a doubt on the accuracy of the specific position of the Ceylonese loach. Moreover, it is quite conceivable that similar environmental conditions may tend to produce similar characters, and that the great resemblance between *N. botia* of India and the one of Ceylon may be due to a similarity in their environments. In the absence of any specimen of Ceylonese *N. botia* for comparative study, it is, however, impossible to judge its affinities. It may yet be pointed out that according to Deraniyagala the base of the dorsal fin of the Ceylonese *N. botia* is "as long as head or pectorals, which latter usually reach ventrals" (p. 38). In all the Indian and the Burmese specimens that I have examined, the base of the dorsal is certainly almost as long as the head or the pectorals, but the pectorals which are invariably shorter than the head hardly reach the ventrals.

From the foregoing account it is quite clear that a certain amount of confusion centres round the true identity of *N. botia.* The species, as it is understood in the present state of our knowledge, is widely distributed in the Indian and the Burmese waters. Below I have given, for future reference, a more or less detailed description of the species from materials from India and Burma. In view of the fact that no adequate figure of the loach has so far been published I take this opportunity to give figures from a well-preserved specimen from the Mali Hka system.

D. 3/11; A. 3/5; P. 1/11; V. 1/7; C. 18 (excluding the small compact outer rays).

The dorsal profile rises from the tip of the snout to the insertion of the dorsal fin with a sudden rise above the orbit. Behind the origin of the dorsal, the outline slopes down slowly, falls appreciably just beyond and below the end of the dorsal base, and then rises up again to the root of the caudal fin. The ventral profile is uniformly and faintly convex. The body is of rather stout build, spindle-shaped and compressed from side to side. It is thinnest at the caudal peduncle, which is squarish in shape and slightly higher than long. The greatest depth of the body is contained from 4.5 to about 5.2 times in the length of the body without the caudal fin. The head is moderate, its length being contained approximately from 4.2 to 4.5 times in the length of the body. It is slightly broader than high. The snout is prominent and somewhat blunt anteriorly. Its length is contained about 2.5 times in the length of the head. The eyes are rather large, placed high and nearer to the angle of the operculum than the tip of the snout. In some grown-up individuals they may be situated almost in the middle of the head. They are scarcely visible from the ventral surface. The orbital width is contained approximately from 3.8 to 5 times in the length of the head. The interorbital space is flat to faintly concave and is almost equal to or slightly narrower than the diameter of the eyes. In front of and below the orbit on either side is a transverse subcutaneous ridge-like prominence. Usually there is no definite groove below the ridge, but in case of most adult male specimens a moderately deep groove is discernible. The nostrils are situated nearer the anterior margin of the orbit than the tip of the snout. The anterior ones are provided with well-developed tubular flaps. The mouth is sub-inferior, moderate and horse-shoe-shaped. The lips are rather fleshy and continuous at the angles of the mouth. The upper lip is provided with a few rows of small fleshy papillae, while the lower one has two rounded, raised cushion-like clusters of similar papillae situated centrally. The lower lip is interrupted in the middle. Both the lips are capable of being partly everted off from the jaws. The upper jaw is slightly longer than the lower and partly overhangs it. Both the jaws are provided with thin and sharp horny edges. The upper one is in the form of a small beak, while the lower one is shovel-shaped with a faint symphysial emargination to receive the upper jaw.[1] The gill openings are in the form of vertical slits extending below the insertions of the pectoral fins. There are two rostral and one maxillary pairs of barbels which are fairly well-developed. All the barbels are much longer than the orbital width.

Usually the insertion of the dorsal fin is much nearer the tip of the snout than the base of the caudal fin, but in some specimens, irrespective of age and locality, it may be situated almost in the middle of the same two points. It is long and in most cases longer than high. The length of its base is equal to that of the head or slightly shorter. Its outer margin is straight and oblique. The paired fins are inserted sub-horizontally. The pectorals are generally shorter than the head and are separated from the origin of the ventrals by a variable distance. The ventrals are situated almost vertically below the middle of the dorsal fin and are shorter than the pectorals. They are separated from the commencement of the anal by a considerable distance. The anal fin is short and when laid flat reaches the base of the caudal or just misses it. The pectorals, ventrals and the anal fins have rounded outer margins. The caudal fin is as long as, or a little longer or shorter than the head. It is longer than high, and faintly emarginate, with somewhat rounded lobes. The anal opening is variable in position, but in most cases it is situated almost midway between the tip of the ventrals and the origin of the anal fin.

The scales are of small to moderate size, conspicuous and imbricate. They are absent on the head and considerably reduced on the chest. The lateral line is generally complete, but in some cases it may be incomplete, not extending beyond the anal fin.

The colouration of the species is very variable, and not unlike most of the other loaches, it depends on the nature of the water and other environmental conditions. Ordinarily, the ground colour is pale olivaceous to yellowish orange with 12 to 16 blackish cross-bars of various turns and twists, descending a little below the level of the lateral line. These bands are generally uninterrupted in the young and half-grown specimens, while in adults they may be broken up into patches, scattered irregularly on the sides. A narrow dark band joins the tip of the snout and the anterior margin of the eyes. Another similar band is present dorsally between the eyes. A prominent black ocellus is usually to be found on the upper base of the caudal fin. All the barbels are dusky, excepting the maxillaries which are white. The fins are yellowish. The dorsal has 5 to 6 oblique, zigzag narrow blackish bands, while the caudal is provided with 5 to 7 posteriorly directed V-shaped dark bands.

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[1] So far as I am aware, such characters of the jaws are found more pronounced in the fast stream-dwelling species of the genus *Nemachilus*. In such habitats as the fish feed almost entirely by scraping and rasping off algae and other organic matters from the rocky substratum, such modifications of the jaws are of the utmost utility.

*Measurements in millimetres:*

| | Northern Bengal | | | Mali Hka System | | |
|---|---|---|---|---|---|---|
| Length of body without caudal. | 70·0 | 57·0 | 50·0 | 102·0 | 88·0 | 63·0 |
| Height of body ... ... | 15·0 | 12·5 | 10·0 | 18·0 | 18·0 | 12·0 |
| Length of head ... ... | 16·0 | 13·0 | 11·5 | 21·0 | 19·5 | 14·0 |
| Breadth of head ... ... | 11·0 | 9·0 | 7·0 | 18·0 | 13·0 | 10·5 |
| Height of head ... ... | 10·0 | 8·0 | 7·0 | 14·0 | 11·5 | 9·0 |
| Length of snout ... ... | 7·0 | 5·0 | 4·0 | 10·0 | 7·0 | 6·0 |
| Diameter of eye ... ... | 3·5 | 3·0 | 3·0 | 4·0 | 4·0 | 3·0 |
| Interorbital width ... ... | 3·0 | 3·0 | 2·0 | 4·5 | 3·5 | 3·0 |
| Height of dorsal fin ... | 15·5 | 13·0 | 12·0 | 19·0 | 18·5 | 12·0 |
| Length of pectoral fin ... | 15·0 | 12·0 | 11·0 | 18·0 | 16·0 | 11·5 |
| Length of ventral fin ... | 11·5 | 9·5 | 9·0 | 17·0 | 14·0 | 17·0 |
| Length of anal fin ... ... | 11·5 | 8·0 | 8·5 | 17·0 | 13·5 | 11·0 |
| Length of caudal fin ... | 16·0 | 13·0 | 11·0 | 22·0 | 18·5 | 13·0 |
| Length of caudal peduncle ... | 8·0 | 6·0 | 6·0 | 12·0 | 10·5 | 7·0 |
| Least height of caudal peduncle ... ... | 10·0 | 8·0 | 7·0 | 14·5 | 13·0 | 9·0 |

### **Nemachilus paucifasciatus** Hora.

One specimen (51 mm.) from Phungin Hka: *'Nga Samwiyit'*.

In 1929, Hora (33) described this species from 15 specimens obtained by Dr. J. Coggin Brown from Hwe-gna-sang river in the Hsipaw State of the Northern Shan States. The single specimen collected from the tributary of the Mali river, which I assign to *N. paucifasciatus*, does not differ from the description and figure of the species excepting that the inner rostral barbels do not extend "as far as the nasal opening". They are much shorter, and the outer rostrals, instead of being extended to "below the middle of the eyes" reach only to the nasal opening.

### **Nemachilus multifasciatus** Day *sensu lato*.

One specimen (50 mm.) from Phungin Hka: *'Sambrun'*.

In his *Fishes of India*, Day described this species from "Darjeeling and Assam"[1] and published an illustration of the fish from a specimen from Darjiling (pl. cliii, fig. 7). In 1889, Vinciguerra (53) reported the species from 'Meekalan' and 'Thagata Juva' near Moulmien in Burma. In his revision of the fishes of the genus *Nemachilus* from Burma, Hora (33) briefly observed that Vinciguerra's specimens from Burma have, in all probability been wrongly referred to *N. multifasciatus* and that the fish "appears to represent a new species". Unfortunately, the unique type-specimen of *N. multifasciatus* from Darjiling which is still preserved in the collection of the Indian Museum is in such a state of maceration that it has become useless for all taxonomic purposes. Moreover, the species seems to be so very rare that since Day's discovery it has not been, leaving aside Vinciguerra's record from Burma, reported again from the Darjiling Himalayas or the adjoining areas, although fairly extensive collections of similar fishes have been made in these areas from time to time by parties of the Zoological Survey of India, and very recently by Messrs. G. E. Shaw and E. O. Shebbeare. Day's descriptions and figures of *Fishes of India*, in general, have been found to be so indefinite and inaccurate that it is often impossible to judge the precise limits of a species without having fresh specimens from the type-locality as a check. Under these circumstances nothing can be said definitely in regard to the specific limits of Day's *N. multifasciatus*, and the fish must be understood and shall remain provisionally known from whatever descriptive accounts it has to its credit until such time as the typical form is again obtained and definitely studied. It seems justifiable, therefore, to make reasonable allowance, so far as this fish is concerned, for minor differences in body proportions and colouration, etc., rather than to consider these as differentiating characters.

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[1] Dr. S. L. Hora kindly informs me that during his visit to Europe he had examined a specimen (No. '89.2.1.1669') in the collections of the British Museum (Nat. Hist.) which is labelled in Day's hand-writing as *Nemachilus multifasciatus*. The specimen was collected by Day from Assam.

Sometime ago, Dr. D. Vinciguerra of the Genova Museum kindly presented a specimen of his Burmese *N. multifasciatus* to the Indian Museum. I have thoroughly examined the specimen and I am in agreement with Hora's view that the fish, judging it by Day's description of *N. multifasciatus*, appears to be new, differing from the latter chiefly in certain body proportions. But in view of what has already been said about the merit of Day's accounts and of the well-known plasticity of shape and structure under variable environmental conditions, of the stream-dwelling loaches in general, I do not propose to separate the Burmese *N. multifasciatus* from the one of India. As for the difference in colouration of the Burmese form, it is to be regarded as no more than a racial character, for, it is well known that most of the freshwater fishes of Burma have a characteristic brilliance of colouration.

In Colonel Burton's collections from the Mali Hka system there is a single specimen which is inseparable from Vinciguerra's specimen from 'Meekalan', although it differs somewhat in colouration.

Quite recently, Dr. H. M. Smith, of the Fisheries Department, Bangkok, Siam, collected several specimens of a species of *Nemachilus* from Northern Siam and sent a fine series to Dr. S. L. Hora for study and opinion. In forwarding the specimens Dr. Smith wrote that the fish "seems to be close to *multifasciatus*. It agrees in (1) very short barbels, (2) short pectorals,

(3) shape of caudal, (4) complete lateral line, (5) black bar at base of caudal and (6) general colouration, but (1) is more slender and (2) colouration of fins different''. Having examined these Siamese specimens and after comparing them with Vinciguerra's form Dr. Hora informed Dr. Smith in a letter that the Siamese fish ''is undoubtedly *N. multifasciatus* of Vinciguerra (but not of Day)'' and that ''Vinciguerra's *N. multifasciatus* appears to represent a new species'', of which he already had a description written and an illustration made with a view to publish them under a new specific name.

I have also examined the same Siamese specimens, temporarily retained in the Indian Museum for study, and find that they are indistinguishable both from the 'Meekalan' specimen and the one from the Phungin Hka tributary of the Mali river under report and that all these specimens should be referred to one species. But as to whether they are referable to Day's *N. multifasciatus* or to a new species appears to be only a matter of opinion. In the present state of our knowledge of the fish in question, I am personally inclined to refer both the Burmese and the Siamese forms to *N. multifasciatus*. In case it is proved by future studies, based on adequate material, that the typical form of Day's *N. multifasciatus* is specifically distinct from the Burmese and the Siamese forms, the latter may be ranked as a separate species and the following description of the fish from the data before me as also the figure of the 'Meekalan' specimen to be published elsewhere by Dr. Hora will be of help in understanding the affinities of these fishes.

D. 3/8; A. 3/5; P. 1/11; V. 1/7; C. 19 (excluding small compact outer rays).

The profile in front of the dorsal fin is moderately arched, beyond which it is almost straight or a little sloping to the root of the caudal fin. The ventral profile is more or less horizontal or very slightly convex. The body is of a rather slender build, elongated and narrow. It is somewhat compressed from side to side, being thinnest at the posterior end of the caudal peduncle, which is squarish in shape and invariably as long as high. The utmost height of the body is contained from 5.5 to 6.5 times in the total length without the caudal fin. The head is short and a little broader than high; its length is contained from 4.8 to 5.2 times in the length of the body. The snout is moderate and pointed anteriorly. Its length is contained from 2.5 to 3 times in the length of the head. The eyes are small and situated almost in the middle of the distance between the tip of the snout and the angle of the operculum. They are not visible from the ventral surface. The orbital width is contained from 4 to 5.4 times in the length of the head. The interorbital space is usually slightly convex, but in certain adult specimens it may be almost flat. It is generally narrower than the diameter of the eyes. The nostrils are situated much nearer the anterior margin of the orbit than the tip of the snout. They are partitioned by a moderate and thin flap.

The mouth is sub-inferior, arched and of moderate size. The upper jaw is slightly longer than the lower one, and partly overhangs the latter. Both the jaws have sharp horny edges. The upper one is in the form of a small beak, while the lower is somewhat shovel-shaped with a symphysial emargination to receive the beak of the upper jaw. The upper lip is rather short and thin. The lower one is better developed and has faint longitudinal striations in the middle. The lips are continuous at the angles of the mouth. The upper one is capable of being partly everted off the jaw. The lower one is moderately united to the isthmus. The gill-openings are in the form of slightly curved slits, extending from the insertion of the lateral line to below the bases of the pectorals. There are three pairs of short barbels. The outer rostrals are slightly longer than the inner, but are almost equal to the maxillaries.

The dorsal fin is inserted midway between the tip of the snout and the base of the caudal fin or just a little nearer to the former. It is shorter than high, the length of its base being almost equal to the length of the head behind the nostrils; its height is slightly less than the depth of the body below it. The outer margin is straight or very slightly curved. The paired fins are placed sub-horizontally. The pectorals are generally shorter but in some specimens they may be equal to or even a little longer than the head. They are separated from the origin of the ventrals by a distance equalling about half their own length. The ventrals are situated vertically below or a little behind the origin of the dorsal. They are shorter than the pectorals and are separated from the commencement of the anal by a variable distance. They invariably reach as far as the anal opening, which is situated much nearer the origin of the anal than that of the ventrals. The outer margins of the paired fins are somewhat rounded. The anal fin is short and when laid flat it may almost reach the root of the caudal or may be separated from it by a short space. The caudal fin is usually longer than the head, but in some specimens it may be of equal length. It is longer than high and moderately emarginate with more or less equal and blunt lobes.

The scales are rather small and imbricate, but are not inconspicuous. They are more prominent on the posterior half of the body. The head and the chest are without scales. The lateral line is complete.

In regard to the colouration of *N. multifasciatus*, Day (14) observed that "vertical bands as wide as the ground colour pass from the back to the lower surface of the abdomen, *those between the head and the dorsal fin are numerous,* whilst there are about five posterior to it. *In some examples these anterior bands coalesce. A dark band at the base of the caudal* and dark marks on the head radiating from the eye. Fins yellow, the dorsal with four bands of spots and an equal number or more on the caudal. Ventral and anal with two bands each". (Italics are mine.). I find that the colouration of the Burmese and the Siamese specimens does not differ much from Day's description except for the number and the nature of the bands on the body and on the fins. In most specimens the colouration of the different fins is lost in alcohol. In a couple of specimens from Siam, however, I find two distinct blackish bands on the dorsal and two on the caudal fin. Both the ventrals and the anal fins have a faint and narrow band. The characteristic dark band at the root of the caudal fin is present in all the specimens.

*Remarks*: From the present data it may be inferred that *N. multifasciatus* is more common in Burma and in Northern Siam than in the Eastern Himalayas, and that in all probability it is essentially a species of the Burmese and the Siamese waters, its range extending from these areas through Assam to the Darjiling Himalayas. Under normal circumstances, the density of population of a species of fish in any area is found to be inversely proportional to the distance between the centre of distribution and the area concerned. The extreme rarity of the species in the Eastern Himalayas and particularly in the neighbourhood of Darjiling, where fairly extensive collections have been made, seems to corroborate this view.

*Measurements in millimetres.*

| | Meekalan | Phungin Hka | Northern Siam | | |
|---|---|---|---|---|---|
| Length of body without caudal ... | 52·0 | 50·0 | 66·0 | 48·0 | 36·0 |
| Height of body ... ... | 8·5 | 8·0 | 10·0 | 8·0 | 6·5 |
| Length of head ... ... | 10·0 | 10·0 | 13·5 | 10·0 | 7·5 |
| Breadth of head ... ... | 7·5 | 7·0 | 9·0 | 6·5 | 5·0 |
| Height of head ... ... | 6·0 | 5·5 | 7·0 | 5·0 | 4·0 |
| Length of snout ... ... | 4·0 | 4·0 | 4·5 | 4·0 | 2·5 |
| Diameter of eye ... ... | 2·5 | 2·0 | 2·5 | 2·0 | 1·5 |
| Interorbital width ... ... | 1·5 | 1·5 | 2·5 | 1·5 | 1·0 |
| Height of dorsal fin ... ... | 9·5 | 9·0 | 13·0 | 8·0 | 7·0 |
| Length of pectoral fin ... | 11·5 | 8·5 | 13·0 | 8·0 | 7·0 |
| Length of ventral fin ... | 10·0 | 8·0 | 11·5 | 8·0 | 6·0 |
| Length of anal fin ... ... | 18·0 | 17·0 | 10·5 | 17·5 | 6·0 |
| Length of caudal fin ... ... | 12·0 | 11·0 | 15·5 | 10·0 | 7·5 |
| Length of caudal peduncle ... | 6·0 | 7·0 | 9·5 | 7·0 | 4·5 |
| Least height of caudal peduncle. | 6·0 | 6·5 | 9·0 | 6·0 | 4·5 |

### **Nemachilus kangjupkhulensis** Hora.

One specimen (48 mm.) from Tang Hka: *'Zaibru Htu'*.

The species was discovered by Hora (23) in 1921 from the hill-streams of the Manipur Valley where it is said to be "widely distributed". The single specimen from the Tang Hka tributary of the Mali river, which I assign to this species, does not appear to differ in any essential feature from the description of the fish given by Hora or from the type-specimen which I have examined. The colouration of the Burmese specimen is partly lost in alcohol, but it seems to correspond almost entirely to that of the Assamese individuals. The lateral line extends to the commencement of the ventral fins.

The species is recorded here for the first time from Burma.

## FAMILY: CYPRINIDAE.

### Genus: **Garra** Hamilton Buchanan.

When urging the revival of the oldest available generic names Jordan (39) pointed out that Hamilton Buchanan's *Garra* (1822) is a valid genus and it replaces *Discognathus* Heckel (1842). In his elaborate studies of the fishes of the genus *Garra*, Hora (24) discussed the matter in detail and stressed the validity of the genus *Garra* and pointed out its relationships with the allied genera. This removed the confusion that till then obscured the true status of the names *Garra* and *Discognathus;* and it was due entirely to this confusion that an indiscriminate use of both the names *Garra* and *Discognathus* found place in ichthyological literature. It is unfortunate, however, that some ichthyologists still uphold the name *Discognathus*, which despite its being more significant and suitable for the disc-mouthed fishes than *Garra*, has no nomenclatural status.

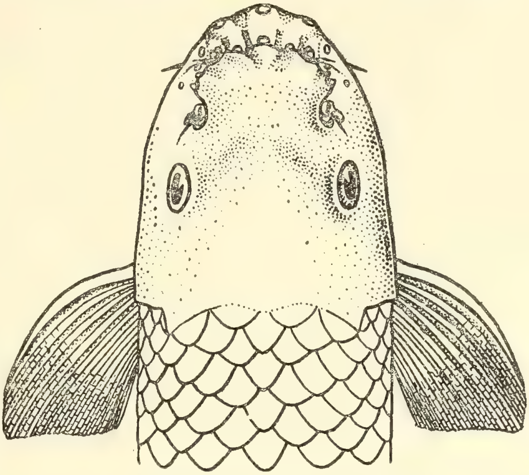
Bleeker (2) divided the genus *Garra* into two groups *viz.*, *Garra* and *Discognathus* according as the fish have four or two barbels. Subsequently, Garman (18) suggested a third group for such forms as *G. imberbis* Vinciguerra in which the barbels are absent. He called it *Ageneiogarra*. It appears to me far too artificial and quite unnecessary to split the genus *Garra* into three subgenera on the character of the barbels alone. It is a well known fact that barbels are very variable structures, specially among Cyprinoid fishes. Recently, Rendahl (49), however, has recognised these subgeneric divisions.

### **Garra lamta** (Ham. Buch.) *sensu lato*.

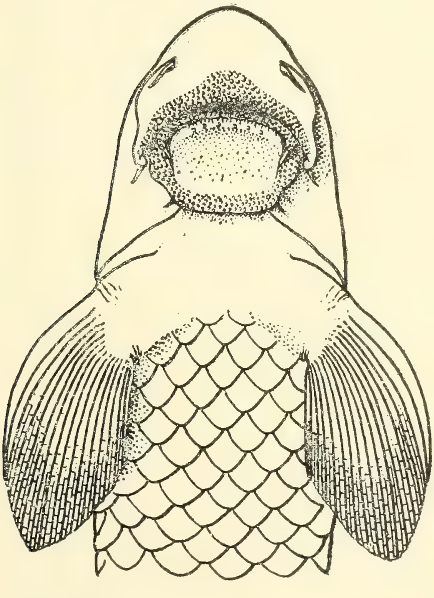
One specimen (116 mm.) from Phungin Kha: *'Wuh tang'*, 'Bulldog mouth'.

The proboscis is trilobed (Text-fig. 4). The central lobe is flat dorso-ventrally and occupies the greater portion of the snout. The lateral lobes are small and are partly overhung by the central lobe. A deep groove marks off the tip of the snout. The anterior portion of all the lobes and the tip of the snout are covered with sharp spiny tubercles. The eyes are dorsolateral in position and are placed wholly in the posterior half of the head.

I have compared the specimen from the Phungin Hka with one of Vinciguerra's *G. lamta* (53) from 'Meekalan' in Burma and have found that the specimens agree in every detail except for the proboscis, which is bilobed in the Meekalan specimen.



Text-fig. 4.—Dorsal view of the anterior portion of the head and body of *Garra lamta* (Ham. Buch.) from the Mali Hka system showing the nature of the proboscis and the tubercles on the snout, ×1½.



Text-fig. 5.—Ventral view of the anterior portion of the head and body of *G. lamta* showing the nature of the mouth, the lips and the suctorial disc, ×1½.

*Remarks*: I provisionally refer the specimen under report to this species as it cannot be reconciled with any other known species of the genus found within the limits of the Indian Empire. Moreover, it has a closer affinity with *G. lamta* than with any other species. *G. lamta* has so far been considered as a composite form. When, however, Buchanan's (20) typical '*Cyprinus* (*Garra*) *lamta*' has been properly understood and defined this form as well as Vinciguerra's *G. lamta* from Meekalan may turn out to be a new species.

### **Crossochilus latius**

(Ham. Buch.).

Two specimens (109 and 119 mm.) from Phungin Hka: '*Nga Lum*'.

The species was originally described by Hamilton

Buchanan in his *Gangetic Fishes* (20) from the "Tista" river at the base of the Darjiling Himalayas under the name '*Cyprinus latius*'. He placed the species in his 9th Division,—'*Cyprinus Garra*', because of certain morphological features and habits that the fish has in common with some species of *Garra*. That Buchanan was not far from the truth in considering *C. latius* a fish of the 'Garra kind'' is proved by the fact that later researches have led most authors tentatively to believe that *Garra* has evolved from a *Crossochilus*-like ancestor. It has been shown by Hora (24) that in certain species of *Garra*, at any rate, the structure of the air-bladder and the skeleton of the mouth-parts resemble those of *Crossochilus*.

Since the discovery of the species from Northern Bengal, the range of its distribution has been extended to "Nepaul and Assam" (11) and to "Sind, Orissa, N.-W. Provinces, Punjab, Deccan and along the Himalayas" (14). In 1890, the species was recorded for the first time from Burma by Vinciguerra (53).

After examining a large series of specimens of *C. latius* from different places of India and Burma, preserved in the collection of the Indian Museum, I indicated in an earlier paper (42) that "the species is very variable in respect of the shape of the head and the body and the lepidosis". But in the absence of any specimens from the type-locality it was not possible for me to go into greater details. Quite recently, however, Messrs. G. E. Shaw and E. O. Shebbeare have collected a fine series of *C. latius* from streams and rivers below Darjiling and have kindly presented several well-preserved specimens to the Indian Museum. Having examined these specimens, practically from the type-locality, I am more than ever convinced that it is necessary to draw a distinction between the group of individuals of *C. latius* found, on the one hand, along the Eastern Himalayas, *i.e.* in Northern Bengal, Assam and in Burma, and, on the other, those that are distributed in the Punjab and the N.-W. Provinces. Furthermore, the Assamese and the Burmese forms differ in certain noteworthy characters from the typical form. No specimens from Orissa, Sind and Deccan are available for examination at the present moment and it is, therefore, not possible to comment on them. Below I have given for future reference detailed descriptions of (i) the typical form of *C. latius* from Northern Bengal, (ii) the Assamese and the Burmese form and (iii) of the form from the Punjab.

### Forma typica :

D. 3/8; A. 2/5; P. 1/13; V. 1/8; C. 18 (excluding the small compact outer rays); L. l. 37-42; L. tr. 10 ($5\frac{1}{2}/4\frac{1}{2}$).

The body is more or less elongate. The dorsal profile rises slowly from the tip of the snout to the point of insertion of the dorsal fin, beyond and behind which it gradually converges to the root of the caudal fin. The ventral outline is horizontal or slightly curved. The head is small, flat and compressed, and resembles that of *Garra*. It is considerably longer than broad and almost as broad as deep. Its length is contained from 5 to 5.2 times in the length of the body without the caudal fin. The snout is very prominent, obtusely pointed, smooth, and overhanging the mouth. Its length is contained from 2.2 to 2.4 times in the length of the head. The eyes are fairly large and situated nearer the angle of the operculum than the tip of the snout. They are not easily visible from the ventral surface. The orbital width is contained from 3.6 to 3.7 times in the length of the head. The interorbital space is rather wide and convex and is much wider than the diameter of the eyes. The nostrils are situated nearer the anterior margin of the eyes than the tip of the snout. The gill-openings are moderate, extending from the anterior point of insertion of the lateral line to a short distance below the base of the pectorals. They are broadly attached to the isthmus.

The mouth is inferior and its opening is slightly arched. The upper lip is in the form of a fairly broad and crenulated fold overhanging the vestibulum of the mouth. Numerous round and soft papillae are arranged more or less regularly towards its free border. The lower lip forms a median, elevated and fleshy area slightly arched anteriorly. It is not separated from the isthmus and is covered at its anterior border with papillae similar to those of the upper lip. There is no distinct post-labial groove, and usually the lower lip is not connected with the upper.[1]

A pair of rostral barbels, which are usually shorter than the diameter of the eyes, are always present. For the most part they remain hidden inside a moderately deep lateral groove on either side of the snout. These lateral furrows may be indistinctly connected with the angles of the mouth.

The insertion of the dorsal fin is considerably nearer the tip of the snout than the base of the caudal fin. It is almost equidistant from the tip of the snout and the middle or the posterior edge of the base of the anal fin. It is higher than the maximum depth of the body and the length of its own base. Its last unbranched ray is weak, and the last branched ray is divided to the root. The outline is slightly concave. The pectoral fins are nearly as long as the head or a little longer. They are separated from the base of the ventrals by a distance equalling almost half their own length. When fully expanded they have a more or less rounded outer margin. The ventrals are slightly shorter than the pectorals, and are situated vertically below the 3rd or the 4th branched ray of the dorsal fin. They are separated from the commencement of the anal by a distance equalling about half their own length. The anal fin is short and is separated from the root of the caudal by a moderate distance. The caudal fin is strongly furcate, the upper lobe being usually longer than the lower. It is longer than the head and almost as long as high. The anal opening is variously situated. In most specimens the ventral fins extend considerably beyond it, while in others they just reach it.

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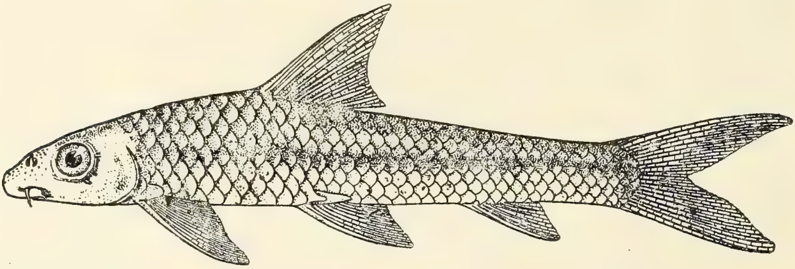
[1] In a number of specimens from the streams of Manipur in Assam, 25 to 45 mm. long, I have observed that there is a well-defined post-labial groove and a distinct connection of the lower lip with the upper; and it seems highly probable that these characters become obliterated as the fish grows. Unfortunately, young specimens from Assam, as well as from other places, are not represented in a sufficient number in the collection of the Indian Museum for a detailed study.

The scales are of moderate size and arranged regularly. There are from 10 to 11 scales before the dorsal fin and usually from 18 to 19 round the caudal peduncle. The scales on the chest are considerably reduced in size, while those situated between the bases of the pelvic fins are somewhat enlarged. The lateral line is more or less straight and extends to the middle of the base of the caudal fin.

Colouration in alcohol is uniformly blackish above the insertion of the lateral line and whitish to faint orange below. The dorsal and the caudal fins are dusky. The other fins are almost colourless.

### Assamese and Burmese form:

I have examined a large series of specimens from Assam collected by Dr. S. L. Hora from various streams in Manipur, and from Burma only three specimens, one from the Kyenchaung river in the Mergui District and two from the Phungin Hka in the Myitkyina District. So far as I can judge, the specimens from these two places do not differ in any essential characters from the typical form except in scalation and in the proportion of the head in the length of the body. In most specimens from Assam and in all the three Burmese individuals I have counted only 8 scales ($4\frac{1}{2}/3\frac{1}{2}$) in a transverse series and from 15 to 16 round the caudal peduncle. In some of the Assamese individuals, however, there may be one more scale in a transverse row. In the typical form there are, as already mentioned above, 10 scales in a transverse series and from 18 to 19 round the caudal peduncle. The head of both the Assamese and the Burmese form is comparatively longer than that of the typical form. Its length is contained from 4.3 to 4.8 times in the length of the body without the caudal fin (*versus* 5 to 5.2 times).



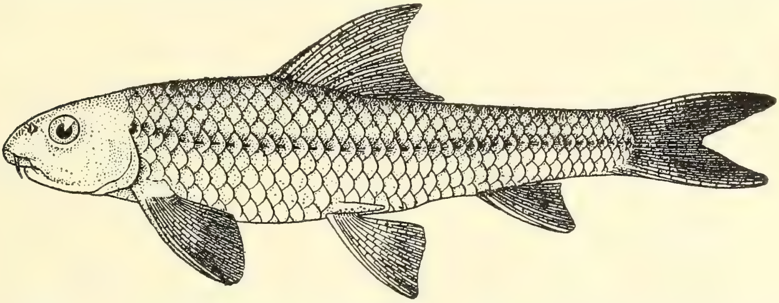
Text-fig. 6.—Lateral view of *Crossochilus latius* (Ham. Buch.) from the Mali Hka system, $\times\frac{2}{3}$.

These differences, however, in the number of scales and in the proportion of the head to the length of the body, do not, in my opinion warrant a claim of a separate taxonomic position for the Assamo-Burmese group of individuals of *C. latius*, and I am inclined to consider them no more than local variations.

### Punjab form :

I have examined[1] a large series of specimens of *C. latius* from the Punjab collected by Drs. S. L. Hora and H. S. Pruthi from Katas Nallah, Salt Range and Khewra Gorge (about 2,000 ft. elevation), and as far as I can judge from the material before me, they seem to represent a distinct form from the typical *C. latius*. In my opinion the specimens from the Punjab, at any rate, should be kept as a separate subspecies until the chief differential characters noted below can be correlated with the ecological conditions in which the fish lives. For the subspecies I propose the name **punjabensis.**

*C. latius punjabensis* appears to be a dwarf form, the largest specimen at my disposal from the Salt Range is 136 mm. in length. On dissecting a number of female specimens from 30 to 45 mm. in length I have found ripe eggs. Unlike the typical form, the fish is stout and thick in build. The snout is rather blunt and broadly rounded anteriorly. It is not so prominent as in the typical form, and only slightly, if at all, overhangs the mouth. Its length is contained nearly 2.5 times in the length of the head. The length of the head is contained from 4.5 to about 5 times in the length of the body without the caudal fin. The eyes are comparatively small and their diameter is contained from 4.2 to 4.7 times in the length of the head (*versus* 3.6 to 3.7 times). The fold of the upper lip is relatively shorter and less crenulated, and so is the lower lip. The body is usually considerably deeper than the height of the dorsal fin (*versus* dorsal fin higher than the maximum depth of the body). The pectoral fins are usually shorter than the length of the head (*versus* equal to or slightly longer) and consequently, the distance between the tip of the pectorals and the insertion of the ventrals is much greater than half the length of the former.



Text-fig. 7.—Lateral view of *Crossochilus latius punjabensis*, subsp. nov., slightly reduced.

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[1] Since this report went to the press, the Zoological Survey of India received for determination a small collection of fish from Quetta from the Deputy Research Entomologist, Baluchistan. In the collection I found six specimens of different sizes, which correspond to the Punjab subspecies of *C. latius*. I am, therefore, inclined to think that the two specimens of '*Cirrhina latia* H.B.' reported by Zügmayer (*Die Fische von Balutschistan*, p. 24, Munchen, 1913) from Quetta and Kushdil Khan respectively, are also referable to *C. latius punjabensis*.

*Measurements in millimetres:*

| | Northern Bengal. | | | Manipur, Assam. | | | Burma. | | | Salt Range, Punjab. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Length of head without caudal ... ... | 120·0 | 105·0 | 92·0 | 105·0 | 83·0 | 50·0 | 150·0 | 119·0 | 109·0 | 90·0 | 80·0 | 68·0 |
| Height of body ... ... ... ... | 25·0 | 24·0 | 20·0 | 23·0 | 18·0 | 10·0 | 35·0 | 23·0 | 21·0 | 24·0 | 18·0 | 17·0 |
| Length of head ... ... .. ... | 24·0 | 21·0 | 18·0 | 23·0 | 18·0 | 11·5 | 31·0 | 25·0 | 22·5 | 19·0 | 16·0 | 15·0 |
| Breadth of head ... ... ... ... | 15·5 | 15·0 | 12·0 | 15·0 | 11·0 | 7·5 | 21·0 | 16·0 | 15·5 | 15·0 | 13·0 | 11·0 |
| Height of head ... ... ... ... | 16·5 | 16·0 | 13·0 | 16·5 | 12·0 | 8·0 | 22·0 | 17·0 | 16·5 | 16·0 | 14·0 | 12·0 |
| Length of snout ... ... ... ... | 10·0 | 9·0 | 8·0 | 10·0 | 7·5 | 4·0 | 14·0 | 11·0 | 9·0 | 7·0 | 7·0 | 5·5 |
| Diameter of eye ... ... ... ... | 6·5 | 6·0 | 5·0 | 5·5 | 4·0 | 3·0 | 8·0 | 7·0 | 6·5 | 4·0 | 3·5 | 3·5 |
| Interorbital width ... ... ... ... | 8·0 | 8·0 | 6·0 | 8·5 | 6·0 | 3·5 | 11·0 | 9·0 | 8·0 | 8·0 | 7·0 | 6·0 |
| Height of dorsal fin ... ... ... | 31·0 | 28·0 | 23·0 | 25·0 | 19·0 | 12·0 | 36·0 | 30·0 | 29·0 | 20·0 | 20·0 | 17·0 |
| Length of pectoral fin ... ... ... | 24·0 | 22·0 | 18·0 | 19·0 | 16·0 | 10·0 | 30·0 | 22·5 | 21·0 | 18·0 | 18·0 | 15·0 |
| Length of ventral fin ... ... ... | 22·0 | 19·0 | 17·0 | 18·5 | 15·5 | 8·5 | 29·0 | 22·0 | 19·0 | 16·0 | 15·0 | 13·5 |
| Length of anal fin ... ... ... ... | 20·0 | 18·0 | 17·0 | 15·5 | 12·0 | 8·0 | 27·0 | 19·0 | ... | 14·0 | 13·0 | 12·0 |
| Length of caudal fin ... ... ... | 28·0 | 28·0 | 24·0 | 23·0 | 20·0 | 13·0 | 44·0 | 28·5 | ... | 24·5 | 20·5 | 19·0 |
| Length of caudal peduncle .. ... ... | 20·0 | 18·0 | 14·0 | 15·0 | 14·0 | 7·0 | 22·0 | 19·0 | 17·0 | 12·0 | 11·0 | 9·0 |
| Least height of caudal peduncle ... ... | 12·0 | 11·5 | 9·5 | 12·0 | 9·0 | 5·5 | 15·5 | 12·0 | 11·0 | 10·0 | 8·5 | 8·0 |

### **Labeo (Labeo) dyocheilus** (McClell.).

(Pl. II, figs. 2 & 3; Pl. III, fig. 2).

One specimen (200 mm.) from Phungin Hka: '*Nga Lai*'.
One specimen (198 mm.) from Sinan Hka: '*Ulai*'.
One specimen (192 mm.) from Phungin Hka: '*Nga Jan*'.
One specimen (114 mm.) from Sinan Hka: '*Janri*'.
One specimen (42 mm.) from Phungin Hka: '*Ukhang*'.

In 1839, McClelland (41) described and figured the species under the name '*Cyprinus dyocheilus*' from "the clear active currents of the Bramaputra from Middle Assam to the rapids at the extremity of the valley". He further remarked that the fish "appears to be equally unknown (*sic*) in the mountain torrents and sluggish rivers and jeels of the plains". Unfortunately, both the description and the figure of the species given by McClelland are inadequate for determining the exact identity of the fish. Day, in his *Fishes of India* and *Fauna* volume gave rather a general account of the fish, but this and his figure (pl. cxxx, fig. 1) are inadequate for determining the species. According to him *L. dyocheilus* is distributed in the "Sind Hills and along the Himalayas to Sikkim and Assam" (14).

In the collection of the Indian Museum there are only three specimens labelled as *Labeo dyocheilus*, two of which were purchased from Dr. Francis Day, while the third one is a skin of a medium-sized specimen procured by Dr. S. W. Kemp from Yembung (1100 ft.) in the Abor Country in Assam (8). One of Day's specimens comes from Hardwar (No. 1522), and the other from Simla (No. 1533), and they are about 12.6 cm. and 32 cm. in length respectively. These two specimens from the Western Himalayas do not appear to me to represent the true *L. dyocheilus* so far as I am able to judge by comparison with the Abor specimen, which I consider to be the typical form of *L. dyocheilus*. It seems probable that the Western Himalayan form of the species is distinct from the one distributed along the Eastern Himalayas; but in the absence of adequate materials from both of these areas no definite decision on this point can be reached.

Recently, Messrs. G. E. Shaw and E. O. Shebbeare have collected a number of specimens from the rivers near Siliguri at the base of the Darjiling Himalayas and have presented a few of them to the Indian Museum. After a detailed study of all these specimens and comparing them with the Abor specimen, both Dr. S. L. Hora and I referred them to the typical form of *L. dyocheilus*.

In the collections of fishes from the Mali Hka system under report there are 5 well-preserved specimens, as detailed above.

These Burmese examples, although referable to *L. dyocheilus*, differ from it to some extent in lepidosis, colouration, etc.

During the preparation of the present account, a similar specimen has been received by Dr. Hora for determination and as donation to the Indian Museum from Dr. H. M. Smith of the Department of Fisheries, Bangkok, Siam. Dr. Smith remarked that the fish "came from the north-western Siam, from a stream at Meh Sord on the Burmese border. It is unlike anything else in our collection". The specimen has, however, been identified as *L. dyocheilus*, and it may be noted that this is the first record of the species from Siamese waters. On re-examination of this Siamese specimen I find that it corresponds entirely to the Burmese form and has the same differences from the Indian individuals. Thus it seems that *L. dyocheilus* is a very variable species, and according to its geographical distribution the species may be divided into the following main groups:

(i) Western Himalayan form.
(ii) Eastern Himalayan and Assamese form, *i.e. forma typica.*
(iii) Burmese and Siamese form.

From the foregoing data it is clear that it is not possible at the present moment to deal with the Western Himalayan form, while detailed accounts of the typical and the Burmo-Siamese form may be given for future reference. Below I have given a description of the *forma typica* of *L. dyocheilus* and the diagnostic features as also figures of the Burmese type.

### Forma typica ;

D. 3/12; A. 3/5; P. 1/17; V. 1/7; C. 19 (excluding the small compact outer rays); L. 1. 40-44; L. tr. 16-17 ($9\frac{1}{2}$-$10\frac{1}{2}$/$6\frac{1}{2}$-$7\frac{1}{2}$).

The head and the body are laterally flattened. The head is rather small and narrow, and covered with a thick integument. It is much longer than it is broad and deep, the length being contained about 4.5 times in the total length of the body without the caudal fin. It is considerably higher than broad, the breadth being almost equal to its length behind the anterior margin of the eyes. The snout is very prominent, muscular, and more or less pointed anteriorly. In some specimens, there is a distinct depression across it. A fairly deep lateral furrow is present on either side of the snout in all the specimens. The length of the snout is contained from 2.5 to about 3 times in the length of the head. It is provided all over with a series of fairly large open pores. A pendulous rostral fold is present. The eyes are rather small, have a free orbital margin, and are situated much nearer the angle of the operculum than the tip of the snout. The orbital width is contained from 4.5 to about 5 times in the length of the head, and almost 2 times in the length of the snout. The interorbital space is wide and slightly convex. It is nearly twice as broad as the orbital width. The nostrils are situated much nearer to the anterior margin of the orbit than to the tip of the snout.

The mouth is horse-shoe-shaped and sub-inferior. Its opening is wide, the cleft extending nearly to the level of the anterior margin of the eyes. Both the lips are continuous and more or less fleshy. There is a distinct post-labial fold, deep-set in the post-labial groove. The upper lip is protrusible and it partly overhangs the vestibulum of the mouth. The lower lip is widely separated in the middle and reflected from the lower jaw. Internally, it is covered with series of stumpy papillae. A pair of maxillary barbels, which are usually shorter than the diameter of the eyes, are situated at the angle of the post-labial fold. Both the jaws have an inner horny covering.

All the fins are well developed. The insertion of the dorsal fin is considerably nearer the tip of the snout than the base of the caudal fin. It is equidistant from the tip of the snout and the origin of the anal fin; in some cases it is much nearer the former. It is as high as or slightly less than the depth of the body below it. Its outer margin is concave. The pectorals are shorter than the head and are separated from the commencement of the ventrals by a distance equalling nearly half their own length. The ventral fins are slightly shorter than the pectorals and are separated from the insertion of the anal by a distance equalling almost half their own length. The anal fin is nearly as long as the ventrals, and when adpressed just reaches the base of the caudal fin or misses it by only a very short distance. It has a slightly concave margin. The caudal fin is much longer than the head and its own height. It is deeply furcate, the upper lobe in some grown-up specimens being slightly longer than the lower. All the rays of the dorsal, anal, pectoral and ventral fins have thin fleshy lateral lappets which are characteristic of most of the Cyprinoid fishes that inhabit the mountainous streams and rivers.

The scales are of moderate size and are arranged regularly on the body. There are from 40 to 44 scales along the lateral line and from 16 to 17 rows between the bases of the dorsal and the ventral fins. Between the base of the dorsal and the insertion of the lateral line there are from 9½ to 10½ rows, while between the lateral line and the base of the ventrals there are from 6½ to 7½ rows. The predorsal scales vary from 17 to 19. Around the caudal peduncle there are from 22 to 23 scales. The scales on the chest are considerably reduced in size. The bases of the dorsal, anal and the caudal fins are more or less scaly. The scaly appendages of the ventral fins are well-developed.

McClelland (41) has described the colouration of the fish as "bluish or brownish black above and on the extremities of the fins, but bluish-white along the belly; the sides are also bluish-white with various stains of red and yellow on the shoulder", while according to Day (14) it is "of a dull green, darkest above; fins darkest in the centre". It appears that both McClelland's and

Day's notes on colouration of *L. dyocheilus* were made on fresh specimens. In specimens, ordinarily treated and preserved in alcohol, the colouration is from a uniform reddish to greenish-brown above and paler below. There appears to be a faint blackish patch on the 4th and 5th scale of the lateral line.

### Burmese and Siamese form :

In some of the Burmese and Siamese individuals of *Labeo dyocheilus* the head may be slightly shorter than that in the typical form, and the length of the head may be contained about 5 times in the length of the body without the caudal fin. The snout is rather bluntly rounded anteriorly. The depression across the snout is very well-marked. The dorsal fin is variable in height and may be as high as, slightly more or a little less than the depth of the body below it. The pectoral fins are usually shorter than the head; but it seems that in well-grown individuals they may be a little longer. In the Siamese individual from Meh Sord, which is 222 mm. without the caudal fin, the pectorals are longer than the head.

There are from 40 to 41 scales along the lateral line and 13 rows in a transverse series. Between the base of the dorsal fin and the insertion of the lateral line there are 7½ rows of scales, while between the lateral line and the base of the ventrals 5½ rows. Before the dorsal there are about 18 scales, while the scales round the caudal peduncle vary from 19 to 21.

The colouration in alcohol is dark brownish above and yellowish to white below. A fairly large faint blackish precaudal blotch seems to be characteristic of the Burmese and the Siamese forms. A narrow blackish patch on the 4th and the 5th scales of the lateral line is also to be found in some individuals. All the fins are dusky. The central rays of the caudal fin are blackish. In the Siamese specimen traces of fine series of dusky longitudinal lines are discernible on each side of the body. Each scale has a faint reddish dot in the centre.

*Remarks*: *Labeo dyocheilus* is a very variable and widely distributed species. It is known to occur in Northern Bengal, Assam, Burma, along the Eastern Himalayas and in north-western Siam. Day's specimens from Hardwar and Simla, mentioned above, do not seem to represent this species, but any conclusive remarks on the so-called *L. dyocheilus* of the Western Himalayas, are, however, impossible till adequate material from these areas becomes available for further study.

The species is said to be common in Assam; and is known by the local name '*Gorea*'. According to McClelland its "usual size is from one to two and a half feet in length, and though sometimes coarse, its flesh is always well flavoured". Colonel Burton has noted that in the Mali river system in Upper Burma the fish grows "upto 4 lbs."

*Measurements in millimetres:*

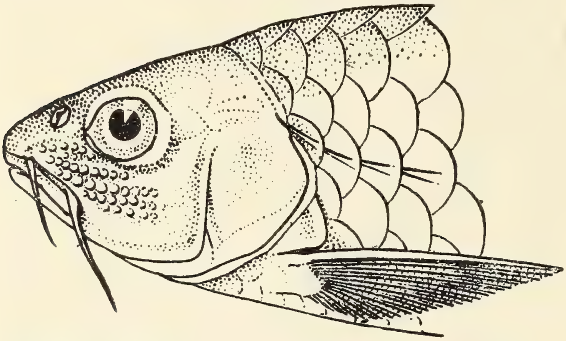
| | North Bengal. | Mali Hka System. | | | Siam |
|---|---|---|---|---|---|
| Length of body without caudal | 205·0 | 198·0 | 192·0 | 114·0 | 222·0 |
| Height of body | 55·0 | 56·0 | 49·0 | 31·0 | 62·0 |
| Length of head | 44·0 | 43·0 | 40·0 | 24·0 | 46·0 |
| Breadth of head | 27·5 | 26·0 | 21·0 | 15·0 | 28·0 |
| Depth of head | 34·5 | 34·0 | 29·5 | 19·0 | 39·0 |
| Length of snout | 16·0 | 15·0 | 14·0 | 8·5 | 17·0 |
| Diameter of eye | 9·0 | 8·5 | 7·5 | 5·5 | 9·0 |
| Interorbital width | 14·5 | 14·0 | 14·0 | 8·5 | 16·5 |
| Height of dorsal fin | 55·0 | 52·0 | 46·0 | 25·0 | 70·0 |
| Length of pectoral fin | 43·0 | 40·0 | 35·0 | 20·0 | 48·5 |
| Length of ventral fin | 41·0 | 37·0 | 32·5 | 19·5 | 45·0 |
| Length of anal fin | 41·0 | 36·5 | 35·0 | 19·0 | 47·0 |
| Length of caudal fin | 58·0 | ... | ... | ... | 50·0 |
| Length of caudal peduncle | 38·0 | 38·0 | 35·0 | 23·0 | 45·0 |
| Least height of caudal peduncle | 27·0 | 24·5 | 23·5 | 13·5 | 28·5 |

## **Barbus compressus** Day.

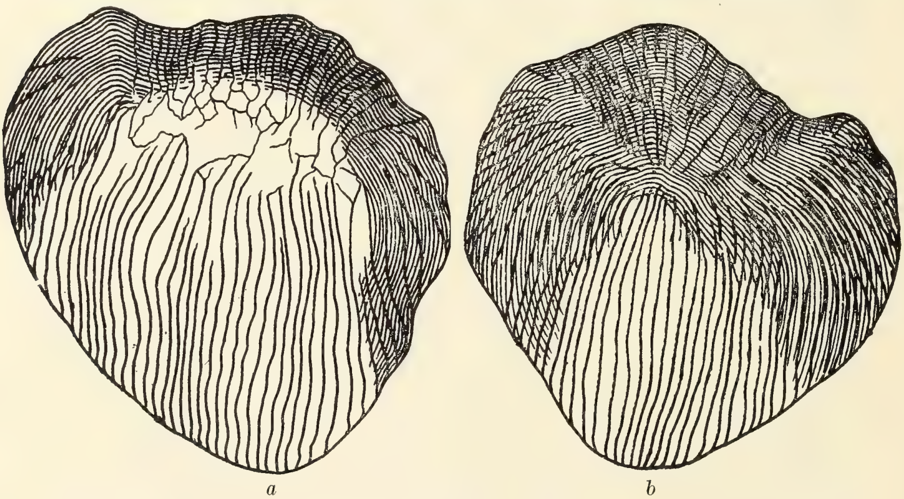
(Pl. I, Fig. 6).

One specimen (122 mm.) from Tang Hka: '*Urat*'.

In 1869, Day (10) described the species from a single specimen, the precise locality of which was not known. He remarked: "The native country of the type-specimen is uncertain, but the fish was found in a bottle in the Calcutta Museum with an *Oreinus* from Cashmere. It is a fine specimen in excellent preservation". Unfortunately, since Day's discovery of the species further material was not available to clear up the doubt in regard to the *provenance* of this interesting fish and consequently little or no attention has been paid to the species. In the collection of the Indian Museum the unique type-specimen of *B. compressus* is preserved in the original bottle. The specimen has not undergone any marked deterioration through preservation in alcohol for a period of sixty-four years, except for the colouration which is completely lost.



Text-fig. 8.—Lateral view of the anterior portion of the head and body of the type-specimen of *Barbus compressus* Day showing the characters of the eyes, mouth, the lips and the barbels etc., ×1½.



Text-fig. 9.—*a*. Scale from the base of the dorsal fin of the type-specimen of *Barbus compressus* Day, ×6.

*b*. Scale from the base of the dorsal fin of *Barbus compressus* Day from the Mali Hka system, ×6.

In the collection of fishes from the Mali Hka system there is a fine specimen which agrees in all essential characters with the type-specimen of *B. compressus* of Day, and I have not the least hesitation in assigning the fish to this species. In view of the fact that *B. compressus* stands rather on an inadequate description based on a single specimen and that the fish has not been figured so far, I take this opportunity to give a detailed description of the species based on a comparative study of both the type-specimen and the Mali river example and to publish an illustration of the latter. To facilitate comparison, a figure of the anterior portion of the type-specimen, showing the characters of the head and eyes, etc. is also added (Text-fig. 8). Characters of scales have often been considered to be of specific value among Cyprinoid fishes. I have, therefore, given camera lucida drawings of the scales of the two specimens under report, The scales are taken from below the base of the dorsal fins (Text-fig. 9, *a* & *b*). It is clear from the structure of these scales that they are more or less similar except for some minor differences which are almost certainly due to a difference in the age of the two specimens.

D. 4/8; A. 3/5; P. 1/14; V. 2/8; C. 26 (excluding the small compact outer rays); L. 1. 25-26; L. tr. 7 ($4\frac{1}{2}/2\frac{1}{2}$).

The dorsal outline ascends gradually from the tip of the snout to the nape where it falls slightly and then rises up again to the origin of the dorsal fin. Beyond this point the outline slopes down rather abruptly and converges to the base of the caudal fin. The ventral outline is feebly convex throughout.

The head is conical, considerably compressed; and its length is contained nearly 4 times in the length of the body excluding the caudal fin. It is higher than wide, the maximum height being equal to the length of the head without the snout, while the width is equal to the length of the head behind the middle of the eyes. The snout is obtusely pointed and almost as long as the diameter of the eyes. The eyes are of moderate size and situated in advance of the middle of the head. Their diameter is contained nearly 4 times in the length of the head. The interorbital region is somewhat convex and its width is nearly equal to or slightly less than the diameter of the eyes. There are 5 to 6 transverse series of well developed conical tubercles on the anterior portion of the cheeks. On the snout there are no pores. The lips are thick and fleshy. The upper jaw is slightly longer than the lower one and is protrusible. Two pairs of barbels are present. The maxillary barbels are slightly longer than the diameter of the eyes. The rostrals are shorter than the maxillaries.

The dorsal fin is situated much nearer to the tip of the snout than to the base of the caudal fin. The insertion is vertically above the posterior margin of the 7th scale of the lateral line. The last undivided dorsal ray is fairly strong and smooth posteriorly. The height of the dorsal fin is as long as the head behind the opening of the nostrils. Its outer margin is slightly concave. The pectorals are as long as the head excluding the snout, and are separated from the insertion of the ventrals by a distance equalling about $\frac{1}{3}$ their own length. The ventrals are considerably shorter than the pectorals and are separated from the origin of the anal by $\frac{1}{2}$ their own length. The anal fin is rather short and extends to the middle of the caudal peduncle. Its outer margin is similar to that of the dorsal. The caudal fin is longer than high, the length being slightly more than the length of the head without the snout.

The scales are large and arranged regularly. There are 9 scales before the dorsal fin and 10-11 round the caudal peduncle. The bases of the dorsal and the caudal fins are scaly. The scaly appendages of the ventrals are fairly well developed.

The colouration of the type specimen has been described by Day as "silvery, fins stained darker". But, as already mentioned, the original colour of the specimen is totally lost. It is now uniformly brownish with a faint golden sheen. The specimen from the Tang Hka is dusky all over the body above the lateral line and pale yellowish below. A fairly large black ocellus is present at the base of the caudal fin. Each scale is marked with a small dusky spot at the base. All the fins are dusky.

According to Colonel Burton's notes the fish is said to grow "up to 4 lbs.".

*Remarks*: From a careful examination and a thorough comparison of the two specimens under report I am convinced that the Burmese example is indistinguishable from the type-specimen of *B. compressus* Day. It is impossible, however, to come to any definite conclusion in regard to the type-locality and the distribution of the species even in the light of the present discovery of the species from Burma. For, on the one hand, its distribution may be sporadic in Kashmir and in Burma, while on the other, the fish may be an endemic Burmese form. Considering the very specialised nature of the fish-fauna of Kashmir, the former does not seem to me to be very probable, while in the event of the latter being true, which I am more inclined to believe, it is self-evident that, through inadvertence, the type specimen of *B. compressus* had been put in the same bottle with an *Oreinus* from Kashmir.

*Measurements in millimetres*:

| | Type specimen | Burmese specimen |
|---|---|---|
| Length of body without caudal .. ... | 155·0 | 122·0 |
| Height of body ... ... ... ... | 40·0 | 34·0 |
| Length of head ... ... ... ... | 38·0 | 31·0 |
| Breadth of head ... ... ... ... | 23·0 | 18·0 |
| Height of head ... ... ... ... | 27·5 | 22·0 |
| Length of snout ... ... ... ... | 11·5 | 10·0 |
| Diameter of eye ... ... ... ... | 10·0 | 8·5 |
| Interorbital width ... ... ... ... | 9·5 | 7·5 |
| Height of dorsal fin ... ... ... ... | 34·0 | 26·0 |
| Height of last undivided dorsal ray ... ... | 34·0 | 26·0 |
| Length of anal fin ... ... ... ... | 27·5 | 20·0 |
| Length of pectoral fin ... ... ... | 32·0 | 24·5 |
| Length of ventral fin ... ... ... | 26·0 | 18·5 |
| Length of caudal fin ... ... ... | (Broken) | 24·0 |
| Length of caudal peduncle ... ... ... | 30·0 | 20·0 |
| Least height of caudal peduncle ... ... | 18·5 | 13·5 |

### **Barbus tor** (Ham. Buch.) *sensu lato.*

One specimen (190 mm.) from Phungin Hka: '*Shabyin Ningshaw*'.
One specimen (134 mm.) from Phungin Hka: '*Nga Kat*'.
One specimen (132 mm.) from Tang Hka: '*Shamyin Ningshaw*'.
One specimen (64 mm.) from Phungin Hka: *Hkauka La*'.

In a recent paper Deraniyagala (17) has revived the genus *Tor* Gray (1833) of which '*Cyprinus tor*' of Hamilton Buchanan is the type. In the *Genera of Fishes*, Jordan (39) remarked that *Tor* Gray "replaces *Labeobarbus* Bleeker" (p. 139), while about *Labeobarbus* Rüppell (1836) he opined that the genus is "probably not distinct from *Tor* Gray" (p. 186). In the absence of any definite data in regard to the specific limit of Buchanan's (20) *C. tor* which he obtained from the Mahananda River in Northern Bengal, I am unable to agree with Deraniyagala's contention about using the name *Tor* for the species in preference to *Barbus* of Cuvier (1817) of which, *Labeobarbus* and certain other so-called allied genera have by most authors been considered synonyms. In this connection Günther's (19) useful remarks may be quoted. He observed: "Many attempts have been made to divide the Barbels into generic groups, as may be seen from the synonymy. And, indeed, when we consider the great number of species, and the great apparent diversity between the first and the last of the series, a further division must appear to be highly desirable. Yet nothing would be more contrary to the idea of natural genera, the transition from one extreme species to the other being perfect; and those attempts at generic subdivisions prove that the naturalists who proposed them had only a partial acquaintance with the species. The size of the scales, the development of the third dorsal ray, the form of the snout (and consequently of the preorbital) are perfectly useless as generic characters, in consequence of the complete series of intermediate forms. The lips are subject to variation in the same species: thus, for instance, some specimens of *B. bynni* would belong to *Barbus*, others to *Labeobarbus*" (p. 84).

This remark applies equally truly in the case of the genus *Tor* and the species *B. tor*. It is a well-known fact that great confusion centres round the true systematic position of *B. tor*, which is due entirely to the extreme variability of certain differential characters that are ascribed to the species, *viz.*, the length of the head and its proportion to the length of the body, the shape and size of the snout, the nature of the lips, the mesial lobe and the lepidosis, etc. All these features have frequently been found to vary so much in *B. tor* that they almost entirely overlap the distinguishing characters of the so-called allied genera and of the related species. Under these circumstances, I am of opinion that it is futile to recognise the genus *Tor* for such fishes as are widely variable in those very characters on which the genus is based, and that *B. tor* should be regarded as a composite and variable species of *Barbus* until it is possible to understand and define properly the specific limits of Hamilton Buchanan's '*Cyprinus tor*'.

The specimens under report from the Mali Hka system have the dorsal fin rays stained with black. Series of black marks are present in the centre and on the posterior edge of the scales. The pigmentation is more prominent in the upper half of the body than in the lower.

It has been noted in the field-notes of Colonel Burton that the species grows "up to 60 lbs." The fish, however, has been known in Burma to grow to a much larger size, weighing over 90 lbs.[1]

### **Barbus clavatus burtoni,** subsp. nov.

(Pl. III, Fig. 1).

Three specimens (162, 130 and 110 mm.) from Phungin Hka: '*Nga Ju*'.
One specimen (83 mm.) from Tang Hka: '*Nga Ju Chang*'.
One specimen (80 mm.) from Sinan Hka: '*Nga Ju*'.
One specimen (74 mm.) from Tang Hka: '*Nga Ju Hpraw*'.

In 1921, Hora (23) discussed at some length the affinities of *Barbus clavatus* McClelland with its allies and published a description and a figure of the species from several fresh specimens collected by him from the Senapati stream near Kairong in the Naga Hills in Assam. *B. clavatus* has hitherto been found in rivers at the foot of the Sikkim mountains on the northern frontier of Bengal and in the Naga Hills in Assam. Among the fishes of the Mali river system of the Myitkyina District under report, there are 6 well-preserved specimens, as detailed above, which, though very closely related to *B. clavatus*, differ from it in certain characters by which they may be allotted to a separate group. Besides these specimens from the tributaries of the Mali Hka, I have also examined a similar, but much larger specimen (172 mm.) collected by Mr. A. Macdonald from Sahmaw in the Myitkyina District and sent by the Curator of the Bombay Natural History Society to Dr. S. L. Hora for study, in March, 1926. On referring the matter to Dr. Hora and looking through the correspondence, I gather that, from an examination of the specimen in question, Dr. Hora came to a provisional conclusion that it represented a new form from Burma. He also had drawings made of this unique specimen with a view to publish an illustrated account of the fish in the Bombay Natural History Society's Journal as soon as a few more specimens of this interesting fish were available from the same locality for testing the adequacy of the description. But no more examples were obtained and the Sahmaw-fish, therefore, remained undescribed. Having before me a fine series of the same fish in Colonel Burton's collections from the same district of the northern frontier of Burma, it is now possible to judge of the affinities of the fish and to publish its description with figures. I am in agreement with Dr. Hora's original views about the form being new to science and I refer the specimen from Sahmaw, as well as the ones from the Mali Hka system, to a new subspecies of *B. clavatus*. I have the greatest pleasure in associating the new form with the name of Lt.-Col. R. W. Burton. The fish may be characterised as follows:

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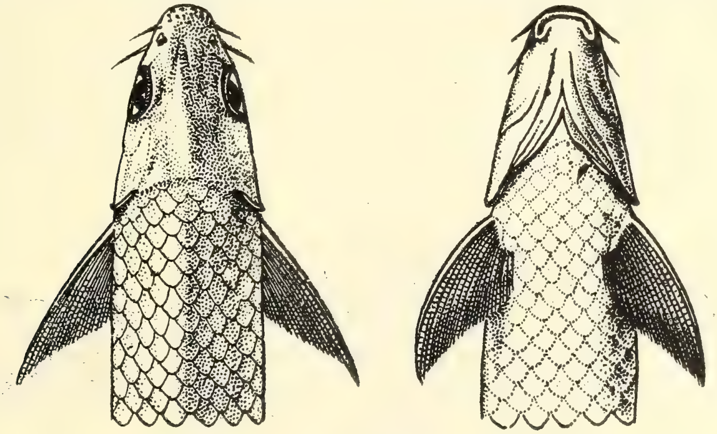
[1] Hertz, W. A., *Burma Gazetteer, Myitkyina District*, p. 17 (Rangoon, 1912).

D. 4/8; A. 3/6; P. 1/16; V. 1/8; C. 19 (excluding the small compact outer rays); L.1. 35-38; L. tr. 10. ($6\frac{1}{2}/3\frac{1}{2}$).

*Barbus clavatus burtoni* differs from the typical form chiefly in size, lepidosis, certain body proportions, colouration, etc. It seems to represent a much larger form than *B. clavatus*, as I find from an examination of the specimens of the latter form from the Senapati stream referred to above as well as two others collected by Dr. Murray Stuart from the Loglai and the Taron rivers in the Naga Hills. All these specimens from Assam are from 45 to 120 mm. in total length without the caudal fin, and some of them about 70 mm. in the minimum and 120 mm. in the maximum are gravid females, whereas the largest female specimen of *B. clavatus burtoni* from the Myitkyina District is 172 mm. long.

The head is short and conical and its length is contained from almost 4 to 5 times in the total length of the body without the caudal fin. It is proportionately longer in young specimens than in adults. The snout is obtusely pointed and is longer than the diameter of the eyes in adult individuals, while in young forms, in which the eyes are relatively larger, it is almost equal to the orbital width. Its length is contained from 3 to 3.3 times in the length of the head. It is provided with 2 or 3 rows of horny tubercles, which are less pronounced in immature stages. The eyes are fairly large and are situated nearer the tip of the snout than the free margin of the operculum. Their diameter is contained from 3.3 to about 4 times in the length of the head. The interorbital space is convex and greater than, or almost equal to the orbital width according as the fish is grown up or young.



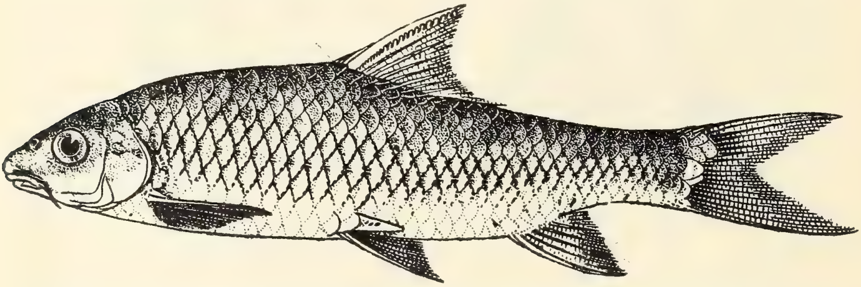
Text-fig. 10.—*a*. Dorsal view of the anterior portion of the head and body of *Barbus clavatus burtoni*, subsp. nov., × *ca*. $\frac{2}{3}$.
*b*. Ventral view of the same, × *ca*. $\frac{2}{3}$.

The mouth is horse-shoe-shaped and sub-inferior. The cleft of the mouth extends nearly to the level of the anterior margin of the orbit. Both the lips are fleshy and continuous, the upper one partly overhanging the lower, which is widely interrupted in the middle. A fleshy pendulous rostral fold is present. There are two pairs of barbels, which are of nearly equal length. They are as long as the diameter of the eyes or slightly longer.

The dorsal fin is inserted almost in the middle of the distance between the tip of the snout and the base of the caudal fin, or slightly nearer the former than the latter. It is of considerable height, but its last osseous spine which is sharply denticulated posteriorly, is not so high as the depth of the body below it. Its outer margin is deeply concave. The pectorals are shorter than the head, but longer than the ventrals. The anal fin is rather short and has more or less a straight outer margin. The caudal fin is deeply forked and usually longer than the head and its own height. In some grown-up specimens the upper lobe is a little longer than the lower. The caudal peduncle is considerably longer than high, specially in adult individuals.

The scales are fairly large and arranged regularly. There are from 35 to 38 scales along the lateral line, and 10 rows between the bases of the dorsal and the ventral fins. Between the base of the dorsal and the lateral line there are 6½ scales, while 3½ between the lateral line and the ventrals. The predorsal scales vary from 12 to 14. The scaly appendages of the ventrals are fairly enlarged. In some large-sized specimens a couple of rows of scales at the base of the caudal fin are considerably enlarged as is seen in the specimen from Sahmaw.[1]

Colouration in alcohol is dark bluish-black or brownish above and pale white below the lateral line. Along the lateral line on either side is present a more or less complete and distinct band in some specimens, while in others, as in the Sahmaw specimen, the free margins of a few longitudinal rows of scales are dotted with fine blackish pigment forming a meshy design (Text-fig. 11). The fins are dusky to whitish. The outer borders of the caudal fin are tipped with black.



Text-fig. 11.—Lateral view of a specimen of *Barbus clavatus burtoni*, subsp. nov. from Sahmaw in Upper Burma showing colour variation, × *ca.* ½.

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[1] I am indebted to Dr. S. L. Hora for kindly allowing me to publish his manuscript drawing of the Sahmaw-specimen.

*Remarks*: *B. clavatus burtoni* may be easily distinguished from the typical form by its longer snout, shorter third spine of the dorsal fin, fewer scales along the lateral line, in a transverse series and before the dorsal fin, and by the colouration which is more dark than bright and silvery. According to Colonel Burton's field-notes, the fish grows "up to 7 lbs."

*Distribution*: Tributaries of the Mali Hka and Sahmaw in the Myitkyina District of Northern Burma.

*Type-specimen*: No. F. $\frac{11437}{1}$ preserved in the collections of the Zoological Survey of India, Indian Museum, Calcutta.

*Measurements in millimetres*:

| | Sahmaw | Mali Hka system | | |
|---|---|---|---|---|
| Length of body without caudal | 172·0 | 162·0 | 110·0 | 83·0 |
| Height of body | 42·0 | 41·0 | 30·0 | 25·0 |
| Length of head | 35·0 | 35·0 | 26·0 | 20·0 |
| Breadth of head | 23·0 | 21·0 | 14·0 | 11·5 |
| Depth of head | 28·0 | 27·0 | 19·0 | 15·0 |
| Length of snout | 11·5 | 11·0 | 8·0 | 6·0 |
| Diameter of eye | 8·5 | 9·0 | 7·5 | 6·0 |
| Interorbital width | 10·5 | 10·5 | 8·0 | 5·0 |
| Height of dorsal fin | 32·0 | 36·0 | 25·0 | 18·0 |
| Length of pectoral fin | 30·0 | 32·0 | 21·0 | 15·0 |
| Length of ventral fin | 26·0 | 29·0 | 19·0 | 13·0 |
| Length of anal fin | 28·0 | 25·0 | 18·0 | 11·5 |
| Length of caudal fin | 44·0 | 38·0 | 30·0 | 23·0 |
| Length of caudal peduncle | 29·0 | 30·0 | 22·0 | 15·0 |
| Least height of caudal peduncle | 16·0 | 18·0 | 12·0 | 10.0 |

### **Barbus chagunio** (Ham. Buch.).

One specimen (125 mm.) from Phungin Hka: '*Chyet neug*'.

The occurrence of this species in the Burmese waters was unknown till its recent report from the Myitkyina District in Upper Burma by Prashad and Mukerji (45). The specimen under report agrees perfectly with the description of the Burmese specimens given by these authors.

There had been a certain amount of confusion in regard to the specific validity of *B. chagunio*, and the matter was discussed in detail by Hora (32). The relationship of the species *B. chagunio* with *B. spilopholus* of McClelland had also been a matter of dispute. Quite recently it has been shown by Hora and Mukerji (38) that *B. spilopholus* is conspecific with *B. chagunio*. The species is sexually dimorphic. *B. spilopholus* with the prolonged anal rays and well developed tuberculated pads on the snout and the cheeks represents a male, while *B. chagunio* without such characters is a female.

The specimen from the Phungin Hka is a female. It has no definite pores or tubercles on the snout and the cheeks, nor the elongated anal rays.

According to Colonel Burton's notes the fish is said to grow "up to 2 lbs."

### **Barbus chola** (Ham. Buch.).

One specimen (90 mm.) from Phungin Hka: '*Shalum shawng*'.

A very faint blackish mark is present in the middle of the caudal peduncle. Another deep black blotch behind the gill opening is characteristic of the Burmese specimens. The dorsal fin has a black mark along the anterior part of its base and another along the centre. Posteriorly the scales have a dusky spot.

### **Barbus sarana caudimarginatus** Blyth.

One specimen (154 mm.) from Phungin Hka: '*Nga pawk*'.
One specimen (150 mm.) from Phungin Hka: '*Nga bupawk*'.
One specimen (180 mm.) from Phungin Hka: '*Nga tawt*'.

The three specimens, although they have different local names, are all referable to this species. According to Colonel Burton's field-notes '*Nga bupawk*' grows "up to ½ lb.", while '*Nga pawk*' and '*Nga tawt*' grow in weight "up to 2 lbs.", and "4 lbs.", respectively. Since all the specimens represent a single species, these weights must refer to different sizes and, presumably, ages of the fish.

The barbels are blackish dorsally and whitish below. Both the dorsal and the caudal fins are tipped with black. There are very fine blackish longitudinal lines along the sides.

### **Semiplotus semiplotus** (McClell.).

One specimen (44 mm.) from Phungin Hka: '*Salep la*'.
One specimen (67 mm.) from Sinan Hka: '*Salep la*'.
One specimen (90 mm.) rom Phungin Hka: '*Shalum shawng*'.
One specimen (115 mm.) from Tang Hka: '*Udi*'.
One specimen (150 mm.) from Phungin Hka: '*Wudi*'.

According to Colonel Burton's field-notes, in young stages the species is locally believed to represent a "small variety" and known as '*Salep la*'; but when the fish grows to a weight from "4 lbs. to 7 lbs." it is known by the name '*Udi*' or '*Wudi*'.

In all the specimens under report there are from 9 to 12 pores on either side of the snout. The last undivided dorsal ray is slightly longer or shorter than the length of the head according as the specimen is grown-up or young. The same is true in regard to the length of the pectoral fins.

### GENUS : **Rohtee** Sykes.

Most of the earlier ichthyologists adopted the name *Osteobrama* Heckel in preference to *Rohtee* Sykes. Hora (23) has already discussed the matter and has pointed out that Sykes' work (51) was published in 1841, while Heckel established his genus *Osteobrama* in 1843, and that according to the International Rules of Zoological Nomenclature Sykes' genus *Rohtee* has priority over *Osteobrama* of Heckel.

Recently, Tchang (52) has established a genus allied to *Rohtee* (= *Osteobrama*) which he calls *Parosteobrama* to accommodate two specimens of his *P. pelligrini* collected from 'Se-tchuan' (Szechuan) in China. He has defined the genus as follows:

"Corps comprimé; bouche termnale et verticale lèvres cornées; linge latérale plus rapprochée du ventre que du dos; dents pharyngiennes sur 3 rangées; vessie natatoire en 3 parties; dorsale débutant plus près de la caudale que du bout du museau, son troisième rayon simple ossifié, mais sans denticulations; anal longue; abdomen tranchant.

Ce genre est voisin de *Osteobrama* Heckel (*Rohtee* Sykes); il s'en distingue par ses lèvres cornées et par la vessie natatoire en 3 parties."

From the generic definition of *Parosteobrama* as well as from the illustrated description of the species, *P. pelligrini* I find that Tchang has considered the horny jaws and the tri-chambered air-bladder to be the chief distinguishing features.

In certain species of the genus *Rohtee* there is an indication of horny pads on the jaws, and in *Parosteobrama* this condition is probably accentuated.[1]

In my opinion, therefore, the horny covering on the jaws in fishes should, in most cases, be correlated with the environmental conditions of the fish and considered as an adaptive modification, which must vary in accordance with the necessity and the degree of adaptability.

In regard to the three-chambered air-bladder, Tchang observes "vessie natatoire en 3 parties, la premiere, ovale et arrondie aux deux bouts, la deuxieme plus longue que la premiere, la troisieme tres petite". Unfortunately, the author has not published any

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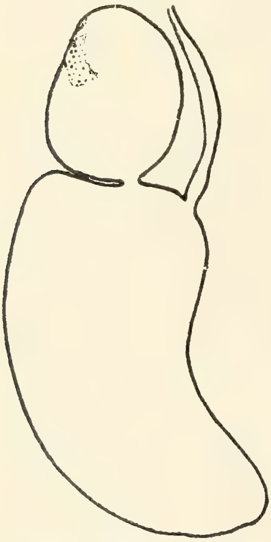
[1] Since this report went to the press, Messrs. H. W. Wu and K. F. Wang's interesting paper—'Preliminary note on the lips of *Parabramis terminalis* (Richardson)'—published in *Contrib. Biol. Lab. Sci. Soc., China*, viii, *Zool. Ser.*, No. 10 (1932) has become available. In dealing with the structure of the epidermis of the lips of *Parabramis terminalis*, which are 'more or less horny in appearance' in specimens preserved in formalin or alcohol, the authors point out 'Tchang recognizes the particular structure as a horny lip (levres cornées) as a characteristic to his new genus in describing *Parosteobrama pelligrini* which is exactly synonymous of the present species. The so-called horny lip which is considered as a characteristic of the genus *Parosteobrama* is merely the highly developed epidermis of the skin covering the surface of upper and lower jaws, and the outer layers of epithelial cells have to become flattened and more or less cornified.'

This corroborates my view regarding the stability of the structure of the lips in *Parosteobrama* and the inference in respect of the validity of the genus illustration of this organ, which in view of its having an additional small third chamber is very interesting. As is well known, in most of the Cyprinoid fishes the air-bladder is bi-chambered. If, therefore, the tri-lobed air-bladder of *P. pelligrini* is proved by the future researches to be a constant feature, the fish will have a claim to a genus to itself. At this stage, however, this character cannot be stressed, inasmuch as the conclusion arrived at by Tchang is based on insufficient data. Moreover, the structure of the air-bladder, although considered to be of taxonomic value, has been known to vary considerably in many Cyprinoid fishes. Hora (24), who studied at some length the structures of the swim-bladder in certain Indian fishes, and specially of the various species of the genus *Garra*, found so much structural variation of this organ that he "was almost tempted to regard it as a specific character; but further examination showed that it is not only variable in the different species of the genus (*Garra*) but differs in individuals of the same species as well". I have examined the air-bladder of *Rohtee vigorsii*, the type-species of the genus, and also of *R. duvaucelii* and *R. feae* from Burma. In all these species I have found that there are only two chambers. The anterior chamber is medium-sized and more or less oval in outline, while the posterior one is fairly large and bean-shaped. The chambers are connected together by a narrow duct at a constriction whence the pneumatic duct arises (Text-fig. 12). The aforesaid three species, as also the rest of the species of the genus *Rohtee*, are not so well represented in the collection of the Indian Museum as to allow many specimens to be dissected, and it is, therefore not possible for me to judge the nature and range of variation of this structure in *Rohtee*, and to throw light on that of *Parosteobrama*.


Text-fig. 12.—Air-bladder of *Rohtee duvaucelii* (Cuv. & Val.) from the Myitkyina District, Upper Burma, ×2.

Another feature which Tchang has included in the generic definition of *Parosteobrama* is that the last osseous ray of the dorsal fin is not serrated, while in *Rohtee* it is usually serrated. In this connection reference may be made to a species of *Rohtee*, *R. cumna* (Tickell) Day in which the last osseous ray is simple. The fish was procured and reported by Colonel Tickell from Mandalay in Burma and considered as a valid species by Day. In his *Supplement to the Fishes of India* Day (15) has also re-defined the fish. Vinciguerra (53), however, accepts the validity of this feature in *R. cumna* with reserve and doubts the accuracy of the structure concerned in Tickell's original drawing of the species.

It is thus clear that to be certain about the validity of the genus *Parosteobrama* examination of further material is essential.

If such an examination reveals that the horny covering on the jaws, the tripartite condition of the air-bladder and the smooth nature of the last osseous ray of the dorsal fin are constant characters in a large series of specimens, *Parosteobrama* will then stand on a firmer basis.

### **Rohtee duvaucelii** (Cuv. & Val.).

One specimen (105 mm.) from Phungin Hka: '*Shaping-naw-naw. kpa*'.

A curious confusion has found currency in the ichthyological literature, both earlier and modern, about the use of the specific name of this species. In 1844, Cuvier and Valenciennes described the species for the first time on page 77 of the 17th volume of their *Histoire Naturelle des Poissons* under the denomination "La Breme de Duvaucel: *Leuciscus Duvaucelii*" after the name of M. Alfred Duvaucel who collected the type specimen from "Nepaul". In the index of the same volume which is prefixed to the text, the name "La Breme d'Alfred (*Leuc. Alfredianus* nob)" is printed on page xvi. But the references affixed to this name are made to the description of *L. Duvaucelii* (p. 77) and to a coloured plate of the fish, No. 488 bearing the legend "*Leuciscus Alfredianus* nob". This discrepancy has resulted in the indiscriminate use of both the names, *duvaucelii* and *alfredianus* in the literature. Under the circumstances it is necessary to decide the question of the nomenclatural status of the two names used by Cuvier and Valenciennes for the same fish. So far as I am able to judge, the question of the "Law of Priority" of names or of "page precedence", as embodied in the International Code of the Zoological Nomenclature does not seem to arise here, nor is there any existing code of nomenclature which provides for such a case as that under consideration. In view of this fact the name *duvaucelii* under which the species was described should, in my opinion, have a natural right to exist, while *alfredianus*, a misnomer in all probabilty, should be eliminated from nomenclature.

In 1924 Myers (43) described a new species of *Rohtee*, *R. roeboides* from a single young specimen, 80 mm. excluding the caudal fin. The fish was collected from Monywa on the Chindwin river in Upper Burma. In a letter Dr. G. S. Myers wrote to me: "In working with the Burmese fishes you may have occasion to examine the cyprinoids I described in 1924. I have become dubious of the validity of *Rohtee roeboides* and *Barbus nicholsi*[1] and should welcome any attempt to properly place these fishes." But since in the absence of typical specimens it is not possible to arrive at any definite conclusion in regard to the validity of these fishes and specially of *R. roeboides*, which concerns me in connection with my present studies, a request was made to Dr. J. T. Nichols of the American Museum of Natural History to send to the Indian Museum the types of these fishes for my examination. In reply Dr. Nichols kindly informed: "I regret that we cannot send you the types of Myers' species for examination, as we are not permitted to send such material outside the country". Thus I have had no chance of examining the type of *R. roeboides*. From Myers' description of the species, however, and after examining a large series of specimens of *R. duvaucelii* of different sizes as well as of the other species of the genus hitherto known from Burma, I have come to a provisional conclusion that *R. roeboides* is strikingly similar, if not identical with *R. duvaucelii*. Myers has already remarked that the species is "related to *Rohtee cotio* (Hamilton Buchanan) and *R. duvaucelii* (Cuvier and Valenciennes)" but "differs from *cotio* and *duvaucelii* in fewer scales (49) and shorter pectorals". It seems that Myers had no specimens of these two species before him for comparison with his species, and that he, therefore, depended considerably on Day's descriptions and figures of these fishes. He pointed out (p. 3 footnote): "Day's figure of *duvaucelii* (*alfrediana*) shows only 45 scales". Unfortunately, Day's descriptions and figures that are given in his *Fishes of India*, though standard references on the subject even today, have often been found to be inadequate and inaccurate for the purpose of understanding the precise limits of the various species; and any conclusion based merely on Day's observations and figures is likely to lead to a mistake.

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[1] I take this opportunity to point out in passing that Dr. D. Vinciguerra described an African species of *Barbus* under the name '*B. Nicholsi*' (*Ann. Mus. Civ. Stor. Nat. Genova,* LIII, p. 11, 1928). According to the International Rules of Zoological Nomenclature, Art. 35, *B. nicholsi* Vinciguerra (1928) becomes a homonym of *B. nicholsi* Myers (1924). I directed the attention of Dr. Vinciguerra to this point who agreed with me and kindly allowed me the liberty to propose a new name for his species. I have great pleasure in renaming the fish as **B. vinciguerrae.**

In an earlier account of the fishes of the Myitkyina District in Upper Burma it has been already pointed out by Prashad and Mukerji (45) that in *R. duvaucelii* the lepidosis is very variable. The number of scales along the lateral line varies from 48 to 52 and there are 9½ to 10½ rows in a transverse series. This conclusion was arrived at after examination of a large series of specimens of the species from various localities. The presence of 49 scales along the lateral line in *R. roeboides*, therefore, does not, *per se*, preclude its assignment to *R. duvaucelii*. In all other respects, as far as I can judge, *R. roeboides* is indistinguishable from *R. duvaucelii*, except for the shorter pectorals. In all the specimens of *R. duvaucelii* that I have examined the pectoral fins either just reach the pelvics or extend slightly beyond them. The length of these fins and their relative proportions, specially in immature stages, can, however, be barely considered to be of specific value.

### **Barilius barna** (Ham. Buch.).

One specimen (53 mm.) from Phungin Hka: '*Shapyin*'.
One specimen (65 mm.) from Tang Hka: '*Nyimaungiza*'.
One specimen (76 mm.) from Phungin Hka: '*Shapyin Pyinneu*'.
One specimen (80 mm.) from Tang Hka: '*Shapin*'.
One specimen (100 mm.) from Phungin Hka: '*Nga-chyet-neu*'.

Although the specimens from different localities as well as from the same locality are known by different local names as quoted above, all undoubtedly belong to *B. barna*. The species is very variable in respect of the presence or absence of barbels, their numbers and the colour pattern, etc. Hamilton Buchanan (20), Günther (19) and Day (14, 16) observe that barbels are entirely absent in *B. barna*. I have examined a large series of specimens of the species from different places in India and Burma and have found that in some only minute maxillary barbels are present, while others are provided with both the maxillary and the rostral pairs. Specially among the specimens of the species from the Siju Cave and the Garo Hills in Assam, I have found many that are provided with one or both the pairs of barbels. Specimens from Burma under report are, however, devoid of barbels excepting the one from the Tang Hka (80 mm.) which has a rudimentary pair of maxillary barbels.

The species seems to be sexually dimorphic so far as it could be ascertained from the nature of the tuberculated structures on the snout, cheeks and on other parts of the body. In males the snout, the jaws, and the lower portion of the cheeks are thickly covered with pointed horny tubercles. In grown-up males 3 or 4 outer branched rays of the pectoral fins have soft cushion-like elevated ridges in the middle, situated dorsally. These pad-like structures are covered with minute tubercles. Some fine tubercles are also present on the last few branched rays of the dorsal fin of some of the males. In all the specimens the lower lobe of the caudal fin is longer than the upper. In Burmese forms this feature appears to be more pronounced than in the Indian individuals.

Broad, black vertical bands at the sides, which vary from 7 to 9, are present in all the specimens. The dorsal fin is edged with black and white, white on the top and black below. In most individuals the scales of the upper portion of the body have a fine blackish outline.

### **Barilius barila** (Ham. Buch.).

One specimen (81 mm.) from Phungin Hka: '*Hkumpyi Ulum*'.
One specimen (81 mm.) from Phungin Hka: '*Shapyin*'.
Two specimens (95 and 105 mm.) from Tang Hka: '*Shapin*'.
One specimen (101 mm.) from Sinan Hka: '*Shapyin-Pyinzut*'.

It appears from the local names quoted from the field-notes of Colonel Burton that the fish is known by different names in the same and in different localities. Comparing certain local names of *B. barila* with those of *B. barna* it further appears that in certain localities, at any rate, the Kachins do not recognise them as two distinct species. For instance, both the species are known by the names '*Shapyin*' and '*Shapin*' at Phungin Hka and Tang Hka respectively, although elsewhere they have other local names.

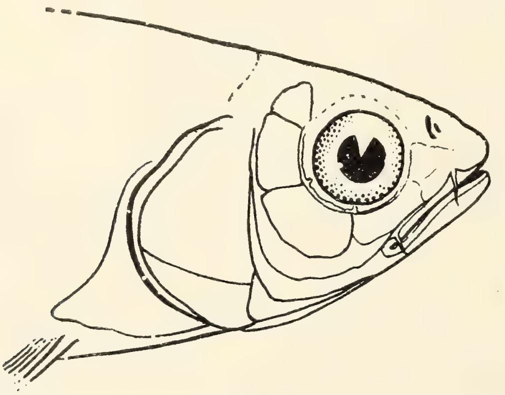
Like the preceding species, *B. barila* is considerably variable in respect of certain characters, and at certain stages of growth the two species are so very similar that it is difficult to differentiate one from the other. In this connection mention may be made of *B. barnoides* described from 'Catchin' in Burma by Vinciguerra (53). I have examined a para-type of the species kindly presented to the Indian Museum by Dr. D. Vinciguerra. A thorough examination of this form and a detailed comparison with its allies has convinced me that *B. barnoides* is conspecific with *B. barila.* I have discussed this matter below under a separate heading.

Both Hamilton Buchanan (20) and Günther (19) have observed that in *B. barila* the barbels are absent, while according to Day (14, 16) "a small rostral pair is present". Of the earlier authors, Day has given undue importance to the nature and the number of the barbels in regard to the systematic classification of the different species of the barbelled Cyprinid genera. He has based his synopsis of the species of the genus *Barilius* on the presence or absence of barbels. But this has been found to be faulty which is due partly to Day's having overlooked the minute tendrils in many species of *Barilius*, and partly to his having been influenced by the *a priori* observations of other authors. Day's synopsis of the species of the genus *Barilius* can, therefore, be hardly rigidly adhered to in the matter of determining the specific identity. I have examined large series of *B. barila* from different localities and have found that in most cases there are two pairs of barbels, while two barbels and no barbels are found only in a few cases. In all the specimens from the Mali Hka system there are two pairs of barbels. The rostrals are nearly twice as long as the maxillary barbels.

The sides and the lower portion of the mandible as also the tip of the snout are covered with minute pores and tubercles. There are 10 to 12 vertical black bands along the sides. The posterior margin of the caudal fin is tipped with black.

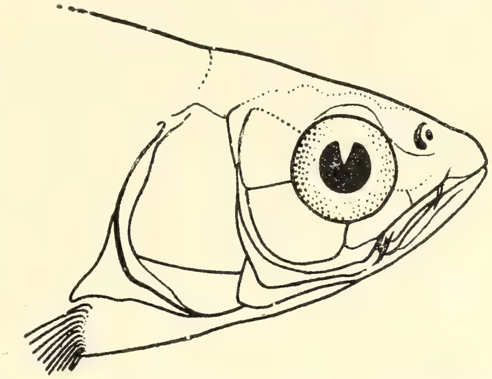
### **Remarks on the identity of *Barilius barnoides*** Vinciguerra:

In 1889, Vinciguerra described the species from 'Catchin' in Burma, and characterised it chiefly by the absence of the barbels and the third suborbital bone not being in contact with the pre-opercular ridge. Having carefully examined a para-type of *B. barnoides* and studied the illustrated description of the species, I have come to the conclusion that *B. barnoides* cannot be considered as a valid species distinct from *B. barila*. In Vinciguerra's form, as I find from the para-type, both the rostral and the maxillary barbels are present which were somehow overlooked by the author. The accompanying illustration (Text-fig. 13) of the anterior



Text-fig. 13.—Lateral view of the head of a paratype of *Barilus barnoides* Vincig. showing relative positions of the third suborbital bone and the preopercular ridge, ×2.

portion of the body of the para-type of *B. barnoides* shows these barbels. The only other character that has been used by Vinciguerra in separating his species from *B. barila* is that in the former the third suborbital bone is not in contact with the preopercular ridge, while in the latter it is said to be in contact. I have examined a large series of *B. barila* of different sizes and from different places and have found that the bones under consideration are very variable in shape and size, etc., irrespective of age and locality; and consequently, their relative positions are also variable. In most cases the third suborbital bone does not lie in contact with the preopercular ridge or according to Day (14, 16) it "nearly" touches the latter (Text-fig. 14). Considering the variability in structures and the relative positions of the third suborbital bone and the preopercular ridge in *B. barila*, I am unable to attach any importance to one bone *touching*, *nearly touching* or *not touching* the other. Leaving aside the questions of the barbels and the position of the third suborbital bone, I find no other character in *B. barnoides* that can be taken into consideration in separating it from *B. barila.*


Text-fig. 14.—Lateral view of the head of one of Day's specimens of *Barilius barila* (Ham. Buch.) showing relative positions of the third suborbital bone and the preopercular ridge, ×3½.

In reaching a conclusion regarding the affinity of his species, *B. barnoides*, Vinciguerra seems to have depended considerably on the short and inadequate descriptions of the allied species given by Günther, Day and others, and this induced him to place his species, which he believed to be non-barbelled, closer to the so-called non-barbelled form, *B. barna*, rather than to *B. barila*, characterised so far with a pair of rostral barbels. From the foregoing accounts of *B. barna* and *B. barila* it is, however, clear that they are different from what they have been understood by Günther, Day and others, and their affinities with related species of the genus must, therefore, be different. At the state of our present knowledge of the three species, *viz. B. barna, B. barila* and *B. barnoides*, it is not possible to recognise Vinciguerra's species as distinct from *B. barila.*

In 1893 Boulenger (4) relegated *B. barnoides* to the synonymy of *B. ornatus* Sauvage without assigning any reasons for it. As I am not familiar with the form *B. ornatus*, I am unable to make any comment on its affinity with *B. barnoides*. It seems to me probable, however, that Boulenger knew *B. barnoides* only from Vinciguerra's description and figure.

### **Danio (Danio) aequipinnatus** (McClell.)

One specimen (80 mm.) from Tang Hka: '*Nga bit*'.
Two specimens (61 mm.) from Phungin Hka: '*Salap la*'.
One specimen (51 mm.) from Sinan Hka: '*Nga wan*'.
One specimen (30 mm.) from ? : ?

Although at different places different local names are used, all the specimens listed above belong to this species. The specimens have the characteristic colouration of the species and a small flake of a metallic blue near the upper angle of the opercles. In some individuals the lower jaw is papillated.

In 1907, Regan (47) described a new species of *Danio*, *D. browni* from the Northern Shan States in Upper Burma. I have examined the type-specimens of this species preserved in the collection of the Indian Museum, and have found that *D. browni* is strikingly similar to *D. aequipinnatus*. I do not find any stable character that can be taken into consideration in differentiating Regan's species from the other. *D. aequipinnatus* is such a variable species, as I find from an examination of large series of specimens from various places in India, Burma and Siam, that it seems impossible to recognise *D. browni* a distinct form.

## FAMILY: BELONIDAE.

### **Xenentodon cancila** (Ham. Buch.).

One specimen (205 mm.) from Tang Hka: '*Singawng tang*'.
One specimen (203 mm.) from Phungin Hka: '*Singawng tang*'.

Two indistinct blackish spots are present above the base of the pectoral fins.

According to the field-notes of Colonel Burton the species is said to grow "up to 3 lbs." The fish is known to grow to a fairly big size. Day (14) observed that it attains at least a foot in length.

## FAMILY: NANDIDAE.

### **Badis badis** (Ham. Buch.).

One specimen (40 mm.) from Phungin Hka: '*Nga-teng*'.
One specimen (57 mm.) from Tang Hka: '*Nkrai daw*'.

There are 10 to 11 vertical black bands along the sides. The dorsal fin is tipped with white. The outer margin of the ventrals is blackish.

The species is very variable in respect of the number of spines of the dorsal fin and of the different fin rays. The nature of the lateral line and the colour pattern are also variable.

## FAMILY: MASTACEMBELIDAE.

### **Mastacembelus armatus** (Lacép.).

One specimen (140 mm.) from Phungin Hka: '*Nga lapu*'.
One specimen (200 mm.) from Tang Hka: '*Shayu*'.

Both the specimens are young and they belong to the same species, although they are known by different local names. The fish is said to grow "up to 7 lbs."

### FAMILY: OPHICEPHALIDAE.

### GENUS: **Ophicephalus** Bloch.

In a recent paper Myers and Shapovalov (44) have shown that in view of the records of occasional absence of the ventral fins in *Ophicephalus gachua* Ham. Buch., *Channa* Scopoli (1777) which has so far been separated from *Ophicephalus* Bloch (1794) chiefly by the absence of the ventral fins cannot be regarded as a phylogenetic entity distinct from *Ophicephalus*, and that according to the relevant rules of the Zoological Nomenclature, the name *Ophicephalus* must be superseded by *Channa*. Although I thoroughly agree, as one must, with the views of Myers and Shapovalov I am for the present retaining *Ophicephalus* for its being an eminently suitable and so very well-known a name. Recently Herre (21) has also retained this name.

### **Ophicephalus gachua** Ham. Buch.

One specimen (147 mm.) from Phungin Hka: '*Khumpup Nga*'.

The species is perhaps the hardiest of all its relatives. It has been observed by Deraniayagala (17) that "*Ophicephalus gachua* flourishes in ponds rendered so stagnant as to prove toxic to most fishes. The swarms of tadpoles and mosquito larvae which thrive in these ponds supply food for the adults and fry respectively. The fish is very hardy and exceedingly active on land, progressing by series of leaps. It propels itself into the air by bending its body, planting its tail on the ground and straightening itself with a jerk, and it is a common sight to find these fishes crossing overland, while the pond they inhabit is baled dry by villagers in search of fish". It has also been found in Ceylon to be able to "withstand a considerable range of temperature from the warm waters arising from the hot springs at Kanniya (E. P.) to the cold waters of Diyatalava (U.P.)".

According to the field-notes of Colonel Burton the species grows "up to 2 lbs." This requires confirmation. So far as I am aware the fish hardly attains that size and Day's remarks about its attaining "at least 13 inches" is probably an over-statement.

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# THE GAME BIRDS AND ANIMALS OF THE MANIPUR STATE WITH NOTES OF THEIR NUMBERS, MIGRATION AND HABITS.

BY

J. C. HIGGINS, I.C.S.

PART IV.

(*Continued from page* 854 *of volume* xxxvi).

## BUSTARDS.

**The Bustard of Assam** (*Sypheotis bengalensis*) is not found in Manipur, and I have never seen or heard of a straggler of any species.

## PLOVERS.

**The Eastern Golden Plover** (*Pluvialis dominicus fulvus*)—Manipuri, *nonggāng*.

Regarding the Golden Plover, Baker[1] says that they appear in Assam in late August, or September, and leave in April. 'Raoul'[2] notes that they reach Bengal in August. In Manipur they arrive and leave just a little later than the Pintail Snipe. The earliest recorded in the bag was shot on August 13th (1913), and I actually saw two on August 7th of the same year. I have shot them on May 13th (1917) and May 14th (1932): and my shikaris have reported them on May 20th (1917), May 29th (1932), and a flock of six as late as June 9th (1932). They are seen annually in August and in May.

In the migration seasons, the Golden Plover is found in flocks, occasionally as large as 200 or 300, on grazing grounds, the edges of *bils*, and in fallow paddy fields, dry or not too wet. In the cold weather most of them seem to disappear, though a few flocks remain on the larger *bils*, where they rest on the islands and feed round the edges. The best year's bag is 83, in 1923-24, and good days (largely contributed to by 'browning' flocks on *bils*) were:—

| | |
|---|---|
| 14-3-20 | ... 44 |
| 3-3-14 | ... 25 |
| 28-9-14 | ... 24 |

The Golden Plover is a curious mixture of simplicity and cunning. The flock invariably puts out one or more sentries, and, unless cover is available, which they usually take very good care there is not, it is difficult to approach them. But I have often employed Baker's device of driving them, with success, and it is extraordinary how, once on the wing, they will often fly straight past or over the guns, even when walking up snipe and making no attempt at concealment.

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[1] *The Game Birds of the Indian Empire*, vol. v, *J.B.N.H.S.*, vol. xxxv, 1, p. 5.

[2] Op. cit., p. 29.

As a table bird, I personally prefer the Golden Plover to the snipe, though I have found very few to agree with me, except 'Raoul.'[1] It is probable, however, that they would pall sooner than snipe as a continued diet.

**The Lapwing, Peewit or Green Plover** (*Vanellus vanellus*).

A very rare visitor. Five were shot on November 29th, 1916, on a grazing ground. I saw 2 on the edge of the Loktak lake on December 26th, 1920, and Colonel Goodall saw a large flock on a *bil* north of the Loktak on February 13th, 1930.

**The Spur-winged Plover** (*Hoplopterus duvaucelii*)—Manipuri, *ngāhoibi* ('fish-chaser'), the same name as is applied to the Redshanks.

This species is resident and breeds. It is found on the shingle beds and sandbanks in streams in or near the hills, and is not particularly common. It is only shot occasionally for the pot, as it is tame and flies so slowly that it can hardly be regarded as an object of sport.

I have never heard them call 'did he do it?', as Baker[2] says they do. The usual call is one sharp note, several times repeated, ending with three staccato notes.

**The Burmese Red-wattled Lapwing** (*Lobivanellus indicus atronuchalis*)—Manipuri, *salangkāk*.

This species resides and breeds, but not in very large numbers. It is shot seldom, for the pot, being tame and a poor flyer.

**The Grey-headed Lapwing** (*Microsarcops cinereus*)—Manipuri, *salang*. In the Journal[3] I wrongly ascribed this name to the Yellow-wattled Lapwing (*Lobipluvalia malabarica*), which does not occur in Manipur.

This species is migratory, but I have never observed the seasons of migration. Baker[4] says he 'never came across them in flocks, but generally singly and occasionally in pairs'. In Manipur they are almost invariably in flocks, sometimes as large as 50 birds, both on the grazing grounds, as well as on the wet ground round marshes and on the *bils*.

**The Eastern Grey Plover** (*Squatarola squatarola hypomela*).

Mr. L. O. Clarke, I.C.S., records that one was brought in to him on October 17th, 1921. It had been killed by a kite.

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[1] Op. cit., *J.B.N.H.S.*, vol. xxxv, 1, p. 33.
[2] Op. cit., *J.B.N.H.S.*, vol. xxxv, 2, p. 243.
[3] *J.B.N.H.S.*, vol. xxviii, p. 290, 'Manipuri Names of certain birds'.
[4] Op. cit., p. 253.

**The Turnstone** (*Arenaria interpres interpres*).

I shot one on September 28th, 1914, on a grazing ground, the identification being confirmed by the Society. I have never seen it before or since.

**The Indian Stone-Plover** (*Burhinus oedicnemus indicus*).

I have only once met with this bird—a single specimen, shot on September 6th, 1932.

**The Great Stone-Plover** (*Esacus recurvirostris*).

These birds arrive just before the Pintail Snipe and only stay until September, being found only on the grazing grounds. They appear regularly every year, and I have seen them as early as July 29th. They are found in small parties (I have seen as many as 14 together) and seem to be particular as to the localities they frequent. On some grazing grounds they never fail to appear, while on others, apparently equally suitable, they are never seen. Presumably they halt on their migration, but I have never seen them on the backward migration. In Manipur they are easy to approach, but are seldom shot.

**The Large Indian Pratincole or Swallow-plover** (*Glareola maldivarum maldivarum*).

I have only once noticed these birds. Mr. C. F. Jeffery shot one out of a small flock on August 16th, 1931. It was identified by the Society and recorded in the Journal.[1]

## OTHER WADERS.

### *Cranes.*

**The Hooded Crane** (*Grus monachus*)—Manipuri, *woinumāl* ('like a sarus'). In the Journal[2] I wrongly ascribed this name to and identified the bird as the Eastern Common Crane (*Grus grus lilfordi*), but from Baker's[3] notes it is clear that the crane of Manipur is *G. monachus*.

This bird is a regular visitor to Manipur, though not in large numbers. They are very wary and none have been shot of late years. But Colonel Cassels records 6 having been shot on December 31st, 1897 and January 1st, 1898. I once hit one, but failed to retrieve it, as it fell a long way off: this is the only shot I have ever had at them. The earliest by far that I have seen them was on September 29th, 1930. They appear to leave early, as I once watched a flock circling to gain elevation in order to cross the western range of hills: I cannot recollect the exact date, but it was certainly before the end of February.

**The Burmese Sarus** (*Antigone antigone sharpei*)—Manipuri, *woinu*, *woinuren* ('the large *woinu*').

This species is not uncommon, residing and breeding in the swamps in the south of the valley: but it is not shot. They are usually seen in pairs, but I once met with a large flock of between 20 and 30. Finn[1] mentions the tendency to collect in flocks as one of the characteristics distinguishing this subspecies from *G. a. antigone*.

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[1] *J.B.N.H.S.*, vol. xxxv, No. 3, p. 686.

[2] *J.B.N.H.S.*, vol. xxviii, No. 1, p. 290.

[3] *Fauna of British India*, vol. vi, p. 52.

### GULLS.

There is only one gull in Manipur (Manipuri, *taotra*) which is common on the lakes in the cold weather. It is fond of associating with the coots (*Fulica atra atra*) and the dabchicks (*Podiceps ruficollis capensis*) and may be seen leading a party of the latter about, like a school. I have never identified it, but it is probably **The Brown-headed Gull** (*Larus brunnicephalus*).

### TERNS.

There are several varieties of terns, which I have never identified. The Manipuri name for them is *ngārākpi* ('fish-catcher'), which is also the term for kingfishers. A smaller variety is also known as *pāt chekpi* ('the lake flying-fox').

**The Avocet** (*Recurvirostra avocetta avocetta*).

Baker[2] says of the Avocet that 'eastward it has occurred as far as Behar'. I once saw a pair in Manipur (date not recorded), and my shikari once shot one and brought it in to me. He has reported seeing it occasionally since (twice, I think, but I cannot be certain, having kept no records). However, there can be no doubt that it is an occasional visitor. Primrose[3] also recorded it from the Goalpara district of Assam in 1908.

**The Eastern Curlew** (*Numenius phæopus variegatus*).

A rare visitor. I shot one out of a pair on October 6th, 1926, and Major E. R. Daboo, I.M.S., shot a single bird on September 10th, 1930. I saw a single bird on December 30th, 1925, another on February 6th, 1930, and three on October 12th and November 2nd, 1930 (probably the same birds, as they were on the same *bil*).

**The Eastern Whimbrel** (*Numenius phæpus variegatus*).

A single bird was shot by Captain Bulfield on August 25th, 1932.

### SANDPIPERS.

There are numerous kinds which I have never identified. The Mainpuris call them *chessā*, *chegaibi*, the former being the name used by the Muhammadans and the latter by the Hindus.

**The Redshank** (*Tringa totanus*)—Manipuri, *ngāhoibi* (cf. the Spur-winged Plover).

A regular visitor. I have never examined the few shot to see whether they are *Tringa totanus totanus* or *T. t. terigontæ*.

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[1] *How to know the Indian Waders*, p. 81.

[2] Op. cit., *J.B.N.H.S.*, vol. xxxv, 3, p. 479.

[3] *J.B.N.H.S.*, vol. xviii, 3, p. 683.

**The Spotted or Dusky Redshank** (*Tringa erythropus*) Manipuri, *ngāhoibi*.

A regular visitor, seen in large flocks. It is a very swift flier.

**The Ruff and Reeve** (*Philomachus pugnax*).

This is an uncommon, though not infrequent visitor. Five have been shot, the identification of two of which was confirmed by the Society.

**The Spotted-billed Pelican** (*Pelecanus philippensis*)—Manipuri, *uphong*.

A fairly common visitor. They appear at the end of the cold weather and leave again after the rains.

### CORMORANTS.

The Indian Shag (*Phalacrocorax fascicollis*)—Manipuri *urā okmāl* ('cormorant like a pig') is found, also the Large Indian Cormorant (*Phalacrocorax carbo sinensis*)—Manipuri *urā pongyai*: these two species migrate. The Little Cormorant (*Phalacrocorax niger*)—Manipuri, *urā khomdol*, is common and breeds. The shikaris always declare that there is a fourth species, which they call *urā mitsang* ('green-eyed cormorant'), which is a little larger than *urā khomdol*, and resides and breeds. Doubtless this is also *P. niger*. The Indian Darter (*Anhinga melanogaster*)—Manipuri, *urā limāl* ('cormorant like a snake') resides and breeds.

### IBISES.

**The White Ibis** (*Threskiornis melanocephalus*)—Manipuri, *māyāng urok* ('the foreign egret' or 'the Cachar egret') is not uncommon. More plentiful is the Glossy Ibis (*Plegadis falcinellus falcinellus*)—Manipuri, *kaksu*, (In the Journal[1] I wrongly classified this bird as the Black Ibis, *Pseudibis paillosus*).

### STORKS.

There are only two storks in Manipur. **The Open-bill** (*Anastomus oscitans*)—Manipuri, *thāroichābi* ('*snail-eater*') or *pāmjenj* (used only by the Hindus)—is very common, being seen in immense flocks and breeding. In the Journal[2] this name was wrongly assigned to the Spoonbill (*Platalea leucorodia major*), which I have never seen in Manipur. The Black-necked Stork (*Xenorhynchus asiaticus asiaticus*), which was formerly found occasionally is now scarcely even seen. The 'Fauna of British India' records the Eastern White Stork (*Ciconia ciconia boyciana*) as found in Manipur, but I have never seen it.

Some at least of the Open-bills migrate, though many are to be seen at all times of the year. On November 12th, 1926, when returning through the hills from Burma, I saw a very large flock circling round and round to gain elevation before crossing the watershed between the Manipur and Chindwin basins—4,750 ft. at that point.

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[1] *J.B.N.H.S.*, vol. xxviii, No. 1, p. 289.

[2] *Loc. cit.*

### HERONS.

**The Eastern Purple Heron** (*Ardea purpurea manillensis*)—Manipuri, *utsai saingāng* ('red-cheeked heron').

This species, which is fairly common, resides and breeds.

**The Eastern Grey Heron** (*Ardea cinerea rectirostris*)—Manipuri, *utsai saingou* ('white-cheeked heron').

Slightly less common than the preceding. It migrates to breed, but returns early, as I saw a pair on August 17th, 1930.

### EGRETS.

The generic Manipuri term for the Egrets is *urok*.

The Eastern Large Egret (*Egretta alba modesta*)—Manipuri, *urok loklenbā* ('the egret which walks in streams'): **The Indian Smaller Egret** (*Egretta intermedia intermedia*)—Manipuri, *langkhongsang* (*khongsang* means 'long legs'): **The Little Egret** (*Egretta garzetta garzetta*)—Manipuri, *naokang;* and **The Cattle Egret** (*Bubulcus ibis coromandus*)—Manipuri, *urok sandungil* ('the egret which follows after cattle') all reside and breed.

### POND HERONS.

**The Indian Pond-heron** (*Ardeola grayii*)—Manipuri, *lamprā*.

This species is common, residing and breeding.

**The Chinese Pond-heron** (*Ardeola bacchus*)—Manipuri, *lamprā amubi* ('the black pond-heron').

This species is not so common as the preceding one, but is far from rare.

**The Indian Little Green Heron** (*Butorides striatus javanicus*)—I am not certain as to the vernacular name, but I think it shares *wākhambong* with certain of the bitterns.

Not uncommon, especially in hill streams, where they debouch into the Manipur valley.

**The Night-Heron** (*Nycticorax nycticorax nycticorax*)—Manipuri, *chongkhu*.

Common: resides and breeds. My shikari declares there are three varieties of night-heron. The other two are known as *chongkhu hawaimān* ('the spotted night-heron') and *tourak chongkhu* ('the reed-bed night-heron'), from its habitat. I have not been able to investigate this statement.

### BITTERNS.

The Malay Bittern (*Gorsakius melanolophus melanolophus*): The Yellow Bittern (*Ixobrychus sinensis sinensis*): The Chestnut Bittern (*Ixobrychus cinnamomeus*): and The Black Bittern (*Dupetor flavicollis flavicollis*) all occur. The three former are known in the vernacular as *wākhambong*, and the last as *honglai amubi* ('the black rail').

### GREBES.

**The Great Crested Grebe** (*Podiceps cristatus cristatus*)—Manipuri, *kumphengbi.*

This species is fairly common.

**The Indian Little Grebe** (*Podiceps ruficollis capensis*)—Manipuri, *upum.*

Very common.

### COOTS.

**The Common Coot** (*Fulica atra atra*)—Manipuri, *porom.*

Very common. It is migratory, and the Manipuris say that it comes with the Pochards, but leaves before them.

**The Indian Purple Coot** (*Porphyrio poliocephalus poliocephalus*)—Manipuri, *umu.*

This species is less common, but is found in suitable localities. It resides and breeds.

### WATERHENS.

**The Chinese White-breasted Waterhen** (*Amaurornis phœnicurus chinensis*)—Manipuri, *uren konthou*: **The Kora or Watercock** (*Gallicrex cinerea*)—Manipuri, *utum;* and **The Indian Moorhen** (*Gallinula chloropus parvifrons*)—Manipuri, *pāt uren* ('the lake waterhen')—all reside and breed.

### JACANAS.

**The Bronze-winged Jacana** (*Metopidius indicus*)—Manipuri, *thamnāchenbi* ('running on the lotus leaves'), and **The Pheasant-tailed Jacana** (*Hydrophasianus chirurgus*)—Manipuri, *yempārābā* ('male fowl') both reside and breed.

### RAILS AND CRAKES.

There are a number of these, which I have never identified. The Manipuri generic name for rails is *honglai.*

### PHEASANTS.

The Manipur valley (except in the swamps, which are unsuitable) is too thickly populated and devoid of forest to be the abode of the pheasant tribe. In the forest-clad hills of the State they are fairly plentiful, and a few are shot every year in the glens which run back into the hills from the main valley. Very little shooting is done in the hills proper, as the jungle is too dense, and game is not sufficiently thick on the ground to make organised driving worth while.

The best year's bag is 67, in 1928-29.

**The Burmese Peafowl** (*Pavo muticus*)—Manipuri, *wāhong.*

This species used to be fairly common in the Manipur hills,[1] but is now practically extinct. The male of a pair flushed in the extreme north of the Manipur valley was shot on January 28th, 1928. The only other record I have of these birds is the report of a hen being seen near the same spot 2 or 3 years earlier (possibly the same bird).

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[1] *Fauna of British India,* vol. v, p. 284.

**The Common Peafowl** (*Pavo cristatus*)—Manipuri, *wahong*.

His Highness the Maharaja has some pairs at the Palace, the offspring of which have run wild over the country to some extent, and have reached the hills east and north of Imphal. It will be interesting to see whether they will be able to establish themselves and replace the extinct Burmese race by the Indian.

**The Bhutan Peacock-pheasant** (*Polyplectron bicalcaratum bakeri*).

This bird is fairly common in the hills, especially in the evergreen forest of the west. In the valley of the Makru river I have heard numbers calling in the early morning of mid-March. They are seldom shot, as they are difficult to find and flush.

Baker[1] describes the call notes as 'a deep, guttural "hoo", rapidly repeated, and a large vocabulary of soft chuckling notes'. The commonest call may be rendered 'ok-kok-kok-kok', and is not unlike that of the English cock pheasant.

**The Common Jungle Fowl** (*Gallus bankiva murghi*)—Manipuri, *lamyel* ('wild fowl').

I have never examined the birds I have shot with a view to identifying them as *G. b. murghi* or *robinsoni*, but Baker[2] gives Assam as the habitat of the former and Burma of the latter subspecies. Probably the two overlap in Manipur, as do the Black and Chinese Francolins. Incidentally the new mongrel scientific name for this species is hardly an improvement on those which it has displaced.

The Jungle-fowl is common in the hills, especially in the foothills of the Kabaw valley (Burma), and in the valleys of the Barak and its tributaries, the Jiri, the Makru and the Irang, on the Cachar border. It is fairly plentiful in the glens running off the main valley of Manipur, where, with the Kalij and a few snipe and woodcock it forms a welcome addition to the bags of Black and Bamboo Partridges made in the spring. The best year's bag of Jungle-fowl, made in 1928-29, is 56, of which 49 were shot in the Manipur valley. The best day's bag is 13, shot on January 28th, 1928, by two guns. In the Kabaw valley of Burma, just at the foot of the hills which form the Manipur border, 45 were shot in three days in January, 1925, though this is not a large bag for the Upper Chindwin district, in which that valley is situated.

**Mrs. Hume's Pheasant** (*Syrmaticus humiæ humiæ*)—Manipuri, *loiningkoi*, *noining* ('l' and 'n' are interchangeable). The name *nongin*, found in various books and articles, is a local name for the bird, but is not Manipuri but Chiru (one of the tribes inhabiting the hills near the valley).

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[1] *Fauna of British India*, vol. v, p. 291.

[2] *Game Birds of India, Burma and Ceylon*, vol. iii, pp. 133, 148.

The range in Manipur given by Hume—'from 2,500 ft. (the height of the lower end of the Manipur plain) to fully 5,000 ft.' is discredited by Baker,[1] on the ground that he could not find the bird in the Jiri valley, which forms the boundary between the Manipur and North Cachar hills on the west of the State. But from the information I have collected, Hume's description is fairly accurate, and Baker's failure to procure one was doubtless due to the fact that the habitat of every bird must end somewhere and the Jiri valley possibly happens to be outside the western boundary of the range of this species. Personally, though I have frequently searched and driven likely places, I have only seen the bird twice. The first occasion was during the rains, at Ukhrul in the eastern hills, just below 6,000 ft. The second was in January, 1918, when the flankers of a column I was out with put one up at Heika (4,700 ft.), in the southern hills. This bird rose out of long grass and dropped at the edge of the strip of forest, down the hill. I did not pursue it, as the Kukis against whom we were operating had been sniping us on the way up the hill. The shikaris report that it is often seen in the valley of the Thoubal river, a tributary of the Manipur river from the eastern hills, at an elevation of 2,700 to 2,900 ft., as late as March. I have had several beats in likely places, but have found nothing except Kalij and partridges. How far it extends into the western hills I do not know. That it does occur there is certain, as the Kukis of the south-west bring in the tail feathers, which form part of the head-dresses of the Manipuri officials, boatmen and dancers, and Mr. J. Needham, I.P., shot a number in the Irang valley in 1918-19. But between the Irang and the Jiri, where Mr. Baker looked for them, lie the valleys of the Barak and the Makru, and three ranges of mountains, one very precipitous and running up to over 9,000 ft.

**The Black-breasted Kalij Pheasant** (*Gennaeus horsfieldii horsfieldii*)—Manipuri, *wābā*.

As Baker[2] says, this species is 'the common pheasant' of Manipur. But it nowhere occurs in the same numbers as the Junglefowl, and escapes being bagged because it is an inveterate skulker and very difficult to flush. The best year's bag is 15, in 1926-27.

In a few Manipuri villages in the main valley, where there are sacred groves belonging to the ancient non-Hindu deities, a few Kalij are to be found. There are quite a number on Thanga, a hilly island in the Loktak, covered with scrub and bamboo, with a Manipuri village along the water's edge. Village Kalij are, needless to say, filthy feeders and quite unfit for the table.

**William's Kalij Pheasant** (*Gennaeus horsfieldii williamsi*).

I was shown the feathers of a Kalij shot in January, 1929, at Karong in the Barak valley, 40 miles north of Imphal, at about 3,500 ft., by Mrs. A. A. Barnard, which were almost certainly those of a male of this species. About a month later, while driving through the hills, I put up a Kalij in almost exactly the same place, which was grey on the head, back and wings, and was presumably another of this species. Baker[1] gives its habitat as 'east of the Manipur river', but all the localities he specifies are in Burma, so presumably it has not been recorded from so far north and west as Manipur. Doubtless this and the preceding species overlap very considerably, as *G. h. horsfieldii* is certainly common for a long distance south of Karong, and has been found in the Chin Hills, at least 100 miles further south, as the crow flies, by Hopwood and Mackenzie,[2] and by Blandy.[3]

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[1] Op. cit., p. 179.

[2] Op. cit., p. 270.

Apparently Beebe does not admit *G. h. williamsi* as a subspecies at all, but 'relegates it to the wild hybrids'.[4] This does not seem probable, as I am almost certain that *Gennæus lineatus* does not occur in the State, and it can be taken as certain that the Karong birds could not have strayed some 100 to 200 miles from the *lineatus* parent.

**The Grey-bellied Horned Pheasant** (*Tragopan blythi blythi*). I cannot ascertain the Manipuri name. Probably the Manipuri, being a man of the valley, does not know this bird.

They are found only in thick forest in the higher ranges, both east and west of the valley. Only one has been recorded, on February 14th, 1928. But Colonel Cassels shot 2 in 1894 and 1 in 1896, and the sportsman who shot the bird recorded in 1928 said that he got another in 1926.

## PARTRIDGES.

Five species are known to occur in Manipur. The local open season sanctioned by the Darbar in from September 1st to March 31st, but very few are shot before Christmas, as the grass and jungle are too thick. The best year's bag, in 1925-26, is 712, made up of 578 Black Partridges, 11 Chinese Francolins and 123 Bamboo Partridges. The percentages of various species in the total bag is:—

| | | |
|---|---|---|
| Black Partridges | ... | 87·29 per cent |
| Chinese Francolin | ... | ·79 ,, |
| Bamboo Partridges | ... | 11·76 ,, |
| Hill Partridges | ... | ·16 ,, |

**The Assam Black Partridge** (*Francolinus francolinus melanonotus*).—Manipuri, *urenbi*, not '*kembi*', as given by Baker,[5] or '*vrembi*', by Finn.[6]

This bird is very common in suitable localities. The best country is found along the foot of the hills surrounding the Manipur valley, particularly on the west and south-west. It is scarce near

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[1] Op. cit., p. 284.
[2] *J.B.N.H.S.*, vol. xxv, 1, p. 91.
[3] *J.B.N.H.S.*, vol. xxvi, 1, p. 289.
[4] Inglis, *J.B.N.H.S.*, vol. xxviii, 4, p. 1118.
[5] Op. cit., p. 202: *Fauna of British India*, vol. v, p. 411.
[6] *Indian Sporting Birds*, p. 230.

Muhammadan villages, as the Manipuri Muhammadan runs it down with dogs, as Travers[1] says the Santals do. It is uncommon in the hills, though it occurs where the valleys and hill sides are open and grassy, as in the upper valley of the Barak. In the western hills, which are mostly covered by evergreen forest and bamboo, it is rare beyond the first range, where the foothills are grassy. In the eastern hills I have seen it in the Iril, Thoubal and Tuyungbi valleys, and as far as Ukhrul, where I put up a bird at 6,000 ft. This village is 34 miles north-east of Imphal, and only 40 miles from the Chindwin river. Elsewhere in the eastern hills I have heard the Chinese Francolin (*F. pintadeanus phayrei*) calling in a number of places, extending as far north as Phuntret (Jessami) in the extreme north-east corner of the State, and I am unable to say what is the boundary between the habitats of the two species. Presumably they overlap in the hills as they do in the Manipur valley. I do not think the Black Partridge extends to the Kabaw valley, across the Burma border. I have visited it on seven occasions, between January and May, spending in all nearly three months in camp in the valley, from the extreme north to the south, and I have never heard the Black Partridge calling there.

In numbers this bird is on the decrease, though slowly. This is due not so much to its being shot out (though this has undoubtedly affected some localities) as to the increase of population and spread of cultivation. The Black Partridge, like his English cousin, is very definitely a bird of cultivation; but in addition he must have water and his little bit of cover to which to retire during the day, and if the latter is destroyed, he moves on elsewhere. The best year's bag is 578, in 1925-26, and good days were:—

| | |
|---|---|
| 25-12-20 | ... 75 |
| 29-12-24 | ... 75 |
| 26-12-25 | ... 67 |
| 16-2-19 | ... 61 |
| 29-12-25 | ... 60 |

The home of the Black Partridge is essentially grass, preferably not too long: it is also necessary that the grass should not be so thick as to prevent the birds from running freely. They are not infrequently found in low oak scrub, and they like grassy groves of silk-cotton (*Bombax malabaricum*). In a well-watered country, like Manipur, they are never found very far from water.

They are great runners and may be seen running rapidly in front of the beaters in open pieces of burnt cover. Birds will, as often as not, run to the end of a piece of cover which has not been burnt, where five or six will rise and fly in all directions, frequently back over the line. The Black Partridge is a tame bird and not a very fast flier (though Baker[2] says that it flies strong and straight), and is very easy to shoot. I fear that very few flushed escape unwounded.

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[1] *J.B.N.H.S.*, vol. xxvii, p. 154.

[2] 'Game Birds of India, Burma and Ceylon', *J.B.N.H.S.*. vol. xxvii, 2. p. 199.

The call, which is intermediate between a hiss and a whistle, consisting mostly of notes not unlike those of a snipe, has been variously described. Baker[1] represents it as *che-chirree chick chiree*, with the accent on the *chick* and the final syllable: he quotes the Muhammadan version as *subhan tere kudrut.* Finn[2] refers to the call as consisting of 'about half a dozen syllables', and quotes Hume as saying that *be quick, pay your debts* is the best English version. The Manipuri version is *mi taret, thāng taret* ('seven men, seven daos'), referring to a folk-tale which ascribes the origin of the bird to a man who was set on and killed by seven rivals in the jungle. What is strange is that no one appears to have noticed that the call consists of *seven* distinct syllables, not six or five; the first being separated from the rest and very short and sharp. This may be due to the fact that the first syllable is so sharp as to be far less audible than the rest. Indeed, some persons find difficulty in hearing the call at all, and I knew one man, whose hearing was normally perfect, who was completely deaf to the call of a bird sitting even a few yards away. The whole call may be represented as '*tk: pss ps-wss ps-wss-wss*', with a pause after the first, second and fourth syllables, which are accented.

The Black Partridge, as Baker[3] and Finn[4] observe, pairs remarkably early in the cold weather, as soon as the young birds are mature, and if a cock is flushed it is always worth while looking for the hen in the vicinity, or vice versa. The cocks are more confirmed runners and harder to flush than the hens.

As a table bird, properly hung, I have always found the Black Partridge excellent and well worth roasting (pace Baker[5]). 'Raoul'[6] appears to agree with me.

**The Eastern or Chinese Francolin** (*Francolinus pintadeanus phayrei*)—Manipuri, *kabo urenbi* ('the Kabaw partridge'), not '*wrengbi*'[7] or '*urengbi*',[8] as given by Baker.

The Chinese Francolin was, I think, never recorded as an inhabitant of Manipur in any scientific or semi-scientific books or papers, until my note in the Journal of 1914,[9] though Colonel Wilson[10] writes, 'the painted francolin or Burmese partridge was found in the tree jungle near cultivation', doubtless referring to this species. I had just made its acquaintance (May, 1914) on my first visit to the Kabaw valley, and was very surprised to find it calling in the foothills of the south-east corner of the Manipur valley, on my return journey. Its distribution in the Manipur valley appears to commence from the glen of the Khuga river (in the south-west corner of the valley), whence it follows the foothills in the south-west, south and east of the valley as far north as Pukhao, in the glen of the Iril river, in the extreme north-east corner of the valley. It has never been recorded or heard north of Kangwai (Survey of India Sheet 83 H/SE, C1) on the western foothills, and Yumnam Khunou (83 H/NE, F1) on the eastern foothills, although the country round the hills in the west and north of the valley has been extensively shot over. It does not frequent the isolated low ranges of hills in the Manipur valley itself. In the hills, I have no knowledge of its occurrence anywhere west of the Manipur and Khuga valleys. It occurs throughout the southern hills, east of the Khuga valley, and in suitable localities in the eastern hills, where I have heard it calling near Chakpi Karong (83 H/SE, E4) and Lambung (83 L/SW, A3), in the valley of the Chakpi: near Sibong (83 L/SW, D3), in the valley of the Lokchao; Khonglou (83 L/NW, F5), in the valley of the Maklang: between Sareikhong (83 L/NW, C1) and Chandrakhong (83 L/NW, B4), in the valleys of the Thoubal and Itok: and near Jessami (83 K/NE, A5) and Wahong (83 K/SE, A1), in the valley of the Viratai. It is possible that it may occur elsewhere in this part of the hills.

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[1] Op. cit., *J.B.N.H.S.*, vol. xxvii, 2, p. 199.
[2] Op. cit., p. 231.
[3] Op. cit., p. 199.
[4] Op. cit., p. 231.
[5] Op. cit., p. 206.
[6] Op, cit., p. 48.
[7] Op. cit., *J.B.N.H.S.*, vol. xxvii, 3, p. 420.
[8] *Fauna of British India*, vol. v, p. 415.
[9] *J.B.N.H.S.*, vol. xxiii, 2, p. 368.
[10] *Sport and Service in Assam and Elsewhere* (1924), p. 177.

The Chinese Francolin is nowhere so plentiful as the Black Partridge, and is not bagged very frequently, as, unlike the latter, it rarely leaves the low oak scrub on the foothills, where the going is laborious and beating difficult. Moreover, it is harder to flush than the latter, and has a disconcerting habit of perching in a high tree and allowing the trouble to pass underneath it. When flushed it is a far stronger flier than the Black. The best day's bag made in the Manipur valley is 5, on March 24th, 1929. I obtained these birds (all I saw), with only 4 beaters and no dog, by marking their call and beating the neighbouring scrub. In the Kabaw valley I once bagged 6 (out of 9 flushed), with ten beaters and a Springer bitch (worth all the beaters put together), in a small grassy stream, surrounded by '*in*' (*Dipterocarpus tuberculatus*) forest. Over the same ground three years later, with 30 beaters and no dog, I flushed two and shot one. The best year's bag is only 11, in 1925-26 (5 in the Manipur valley), and in 1928-29 (10 in the Manipur valley); and only 48 have been shot in all.

The descriptions of its call given by Baker[1]—'*ke kai, ke kai, ke karr*', or '*kai kai, kee kai, kee kurr*' (Swinhoe), and '*hing puh tiy yay, ko ko*' (Chinese)—afford little idea of the actual sound, though they give an indication of the rhythm. The same applies to the Manipuri version—'*aigi pôt kadai?*' ('where are my things?')—said to be the lament of a traveller to Burma who was set upon by dacoits and robbed, and subsequently changed into this bird—a curious link with the Black Partridge. But Wardlaw Ramsay's version, quoted by Finn[1]—'*kak kak kuich, kā kā*' strikes me as being remarkably near to it. With the exception of the Manipuri, the others do not appear to have noticed that there are five notes in the call, not six. For a partridge it is a strangely resonant call.

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[1] *Fauna of British India*, vol. v, p. 415.

In describing this species, it does not seem to have been noted that it possesses a far heavier head and thicker neck, in proportion to its size, than the Black Partridge.

In view of the fact that Baker[2] records that 'hybrids between the Black and Painted Partridges are very common, as one might expect between two game-birds so closely connected, whose habitats overlap', it is strange that none appear to have been recorded between the Black and the Chinese Francolin. I have always been on the lookout for them, but have never seen a bird which might be suspected of being a hybrid, though the Black Partridge is common in all the localities in the Manipur valley where the Chinese Francolin is found.

**The Assam Bamboo Partridge** (*Bambusicola fytchii hopkinsoni*)—Manipuri, *wākrek* (*wā* meaning 'bamboo', *-krek* presumably representing the bird's alarm call, when flushed).

The Bamboo Partridge is common throughout the hills, ascending to a fair altitude, like the Black Partridge. I put up a party of 11 at 6,000 ft. in the northern hills, on March 20th., 1932. I know of one Manipuri village in the middle of the valley, where there is a covey, and a few are found in villages as far as two miles from the hills. It is only in such villages that I have ever seen a Bamboo Partridge anywhere in the neighbourhood of a bamboo. They seem to avoid bamboo jungle in favour of the hill partridges (*Arborophila*), though Finn[3] mentions it as one of their haunts. In the Manipur hills, few of the streams are without at least one covey, and they are fairly common in all the glens off the main valley, being particularly fond of the willow (*Salix tetrasperma*) thickets on the banks of the streams. The best locality is in the upper waters of the Manipur river itself, as far south as Kanglatongbi, where they are found in the low oak scrub on the banks of the tributary streams, and in the mixture of elephant grass, raspberry bushes, oak and willow along the main stream: they are particularly fond of the grass known in Manipuri as '*pullei*' and in Assamese as '*tārapāt*'—a wild cardamum. In this neighbourhood one may put up 50 to 100 birds in a day. The best bag is 128, made in 1928-29, and good days were:—

| | |
|---|---|
| 16-3-30 | ... 27 |
| 14-3-29 | ... 23 |
| 28-3-32 | ... 20 |

The Bamboo Partridge is a strong straight flier when flushed. Finn[4] credits it with being 'generally found in pairs'. This is not the case in Manipur: it is almost invariably found in coveys, and, unlike the Black Partridge, does not pair until March is well in, and not always before the end of the month. Wickham[1] confirms this, saying that this species 'keeps in coveys'. Finn[2] says further that the Bamboo Partridge 'perches freely'. I have beaten them out of bushes, and on one occasion saw a bird take refuge in a high tree, where it most effectually disappeared and could not be dislodged. But they are nearly always found on the ground, and are not such perchers as the Chinese Francolin.

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[1] Op. cit., p. 235.

[2] Op. cit., p. 419.

[4] Op. cit., p. 222.

[3] Op. cit., p. 221.

Wickham's description of their calls as 'a curious chatter', which is quite musical, and a 'scream', when flushed, is accurate. The 'chatter' has been rendered by Baker[3] as '*chi chirree, chi chirree chi chirree*': it sounds to me more like '*pishup, pishup, pishup, pishup, pishup* . . .' (and so on indefinitely).

A day after Bamboo Partridge in the Manipur glens, with two guns, ten or fifteen beaters, and a couple of dogs, is difficult to beat, even in England. At 2,500 ft. the climate is never too hot, up to the end of March, when the partridge shooting closes. The birds, good movers, almost invariably fly for one or both of the hillsides, across the guns. The bag is varied with an occasional Black or Hill Partridge or Chinese Francolin, teal, snipe, woodcock, jungle-fowl, kalij, quail and barking-deer, and, on a good day, may number as many as 50 or 60 head. The going, apart from an occasional swamp, or a thicket of thorns or raspberry bushes, is good.

### The Hill Partridges.

Both the Arakan Red-throated (*Arborophila rufogularis intermedia*) and the White-cheeked Hill Partridge (*A. atrogularis*) have been shot, though rarely. They are not uncommon in the hills—indeed, in places quite the reverse—but are great runners, hard to approach and equally hard to drive in the right direction. I have heard two very distinct calls. One, which Baker[4] accurately describes as '*wheea-whu*', is usually repeated two or three times, followed by a series of three short sharp whistles, '*whu-whu-whu*', in an ascending scale. This, the commoner, which I have also heard in Cachar and Nowgong, nearly as far as the Brahmaputra, is presumably the call of *A. atrogularis*. I have spent several profitless evenings trying to approach one of a large number uttering this call, in various parts of the hills. The other call, a much shorter and softer whistle, which I cannot describe, is probably the call of *A. rufogularis intermedia*. I have never noticed particularly in what localities the two calls are heard, but have heard the two at the same time, both in the western and the southern hills.

I have never been out after Hill Partridges in the north-western hills and have no knowledge of whether the Common Hill Partridge (*Arborophila torqueola torqueola*) occurs, as Baker[5] thinks it probably does.

(*To be continued*).

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[1] 'Notes on the Birds of the Upper Burma Hills', *J.B.N.H.S.*, vol. xxxiv, No. 2, p. 343.

[2] Op. cit., p. 221.

[3] *Fauna of British India,* vol. v, p. 366.

[4] Op. cit., *J.B.N.H.S.*, vol. xxviii, 1, p. 5.

[5] Op. cit., *J.B.N.H.S.*, vol. xxvii, 4, p. 654.

# THE VERNAY SCIENTIFIC SURVEY OF THE EASTERN GHATS (ORNITHOLOGICAL SECTION).

BY

HUGH WHISTLER, M.B.O.U., assisted by N. B. KINNEAR, M.B.O.U.

## PART VII.

(*Continued from page* 844 *of volume* xxxvi).

### **Anthus trivialis trivialis** Linnaeus.

*Anthus trivialis* Linn., Syst. Nat., ed. 10, vol. i (1758), p. 166—Sweden.

Specimens collected:—1098-1100 ♀♀♀ 13-12-29; 1113-1114 ♀♂ 1115 ♀ 1117 ♂ 15-12-29, 1128 [♂?], 16-12-29, Cumbum Valley; 1451-1454 ♀♀♂♂ 1-3-30 Sankrametta 3,500 ft.

Measurements:—

| | Bill. | Wing. | Tail. | Tarsus. |
|---|---|---|---|---|
| 4 ♂ | 14-15 | 83.5-88 | 59.5-65.5 | 20-21.5 mm. |
| 7 ♀ | 13.5-15 | 83-89 | 59-65 | 19-21.5 mm. |

The Tree Pipit was met by the Survey in large flocks in February at Anantagiri and Sankrametta. By the end of March their numbers were greatly diminished and in April they had left the district (La Personne). In this area they had been previously recorded by Ball at Jeypore (S.F., v, 417).

Mr. La Personne also informs me that in the Godaveri Delta Tree Pipits were seen in large flocks in ploughed fields and also frequently met with in wooded areas though no specimens were actually preserved. The series from the Cumbum Valley in December complete the records for this side of the Presidency.

In the *Old Fauna* Oates was unable to record this species south of Belgaum, but its range on the western side of India certainly extends to the Nilgiris as Col. H. R. Baker's collection contains two specimens shot at 6,000 ft. on 26 January 1902. The *New Fauna* states that it reaches Travancore but I have seen no evidence to that effect.

*Anthus trivialis sibirica* Sushkin, to which we should expect our Southern and East Indian birds to belong, does not appear to me to be a race worth recognition. It is evidently the intermediate between the typical race and *A. t. haringtoni* and anyone who has had practical experience of the difficulty of distinguishing those two forms out of their breeding areas will agree that there is nothing to be gained by naming the intermediate.

### **Anthus hodgsoni hodgsoni** Richmond.

*Anthus hodgsoni* Richmond, Blackwelder's Researches in China, pt. ii (1907), p. 493—India.

Specimens collected:—1251 ♀ 14-1-30 Godavery Delta.

Measurements:—

| Bill. | Wing. | Tail. | Tarsus. |
|---|---|---|---|
| 14 | 81 | 59.5 | 20 mm. |

Hodgson's Tree-Pipit is a very common winter visitor to the hills of the western side of the Presidency where it is usually met with in small flocks. In the Wynaad, the Nilgiris, the lower hill country of the Nelliampathies and in the Palnis it seems to be very generally distributed. In Travancore according to Ferguson it is only found at high elevations in the hills and never in the plains. He obtained it both on the High Range and at Chimunji at 4,000 ft. in South Travancore. The numerous specimens which I have examined from this side show that it occurs at least from 13 October to 19 April.

On the eastern side of the Presidency the above Survey specimen and Ball's statement (S.F., v, 417) that it has been met at Jeypore furnish the only records traced.

Now it is evident at the first glance that the very uniform lightly streaked birds found in South-West India are not the same as the heavily streaked birds which breed at high altitudes in the Western Himalayas and winter in the lower ranges and foothills of that area. As this fact does not agree with Mr. Stuart Baker's treatment of the species in the *New Fauna* (vol. iii, pp. 281-283) I have been compelled to examine the races *de novo*. Mr. Stuart Baker recognises three races; the typical race of which he gives the type locality (wrongly) as Nepal and to which he attributes all specimens found in the Himalayas and India proper; *A. h. yunnanensis* (Mengtz, Yunnan) and *A. h. berezowskii* (S. W. Kansu) which occur in Burma, the former said to be much darker than the typical race and the latter intermediate between the other two. Neither of these races can I separate however from the Himalayan breeding bird. As regards the first the describers Messrs. Uchida and Kuroda, Annot. Zool. Japan, ix (1916), p. 134, merely claimed that it seems 'to be constantly characterised by having the bill distinctly shorter than in the typical species', a point which my examination does not bear out. *A. h. berezowskii* was apparently only named by Zarudny at third hand, Orn. Monatsb., vol. xvii (1909), p. 43; he seems never to have seen the specimens he was naming but merely gave a name to some remarks by Berezowski and Bianchi on specimens from Potanin's expedition. The Kansu specimens I have seen agree with Himalayan birds. It must be remembered that great numbers of this Pipit sweep down across Southern Asia in autumn and that it is necessary to distinguish between those migrants and local breeding birds. Both these races, even if good ones and it will be noted that Dr. C. B. Ticehurst (J.B.N.H.S., xxxii, p. 351) has independently thrown doubt on them, are of the same dark heavily streaked type as the Himalayan bird. I find however that Siberian birds are definitely separable. Compared with the Himalayan breeding race the upper parts are greyer and more uniform, the streaks on the hind neck, mantle and back being narrower and much less distinct so that in some specimens the upper parts are almost immaculate or appear merely mottled rather than streaked. The black streaking on the lower parts is both narrower and less numerous, virtually dying out on the flanks and abdomen which also I think do not attain the rich rufous brown wash of Himalyan birds. The under-tail-coverts are white, not warm buffish white as is usual in the latter.

These Siberian birds evidently account for our lightly marked birds in South-Western India and indeed the greater part of India and it is therefore necessary to establish their name; and that must depend on whether *Anthus hodgsoni* Richmond in Blackwelder's Researches in China, pt. ii (1907), p. 493 refers to the heavily or lightly streaked birds. In Jerdon's Birds of India, vol. ii, p. 228 *Pipastes agilis* Sykes is used as the name for this species. In the Appendix, vol. iii, p. 873 Jerdon states that Sykes' *agilis* is the true *arboreus* and that 'the common Indian race therefore will bear Hodgson's name *maculatus*'. This name was however not really available, as it was a *nomen nudum* and had already been made a synonym of *trivialis* and it was in place of Jerdon's name *maculatus*, not Hodgson's *maculatus*, that Richmond gave his new name, which takes the description and type locality of Jerdon's vol. ii, p. 228. The description may perhaps be considered as a composite in which the lightly streaked (Siberian) form is considered the winter plumage and the heavily streaked (Himalayan) form is considered the summer plumage. The type locality is 'all India', the only specific locality mentioned lower down being 'Calcutta and elsewhere in Bengal'. As the lightly streaked Siberian bird is the form found throughout the greater part of India and as the only Bengal specimens I have seen belong to it we shall be safe in attributing Richmond's name to this race.

There is no doubt that Hodgson's *Anthus maculatus* was the heavily streaked Himalayan bird. I have examined his drawings and under the name *maculatus* are figured two very heavily streaked specimens, whilst the plain-backed bird is separately figured as *Anthus brevirostris* Mihi, a name which also is unusable. Both forms are represented in his specimens in the British Museum. Jerdon's *Anthus maculatus*, however much it derived in the

Author's mind from Hodgson, has nomenclatorially to be treated as a separate conception.

The Himalayan breeding form will then take, under my views as expressed above, the next available name namely *Anthus hodgsoni berezowskii* Zarudny (loc. cit.).

The single specimen obtained by the Survey is somewhat intermediate.

[Since the above was written part ii of the Supplement to Die Vögel der paläarktischen Fauna has appeared and Dr. Hartert and Dr. Steinbacher have described the lightly streaked form as *Anthus hodgsoni inopinatus* (Sakhalin). If my view as detailed above is correct then *inopinatus* will become a synonym of *hodgsoni*. See also Ibis 1933, p. 571.]

### **Anthus nilghiriensis** Sharpe.

*Anthus nighiriensis* Sharpe, Cat. Birds Brit. Mus., vol. x (1885), p. 550—Nilgiris.

The Nilgiri Pipit is peculiar to the Madras Presidency where it is resident and only known to occur at high elevations in the hill ranges of the South-West. On the Nilgiris it is restricted to the pleateau where its haunts are the open downs covered with short grass and it does not occur below about 6,000 ft. (William Davison) or 5,000 ft. (Betts). Within these limits it is common. It is similarly common at 7,000 ft., and probably lower, on the grassy downs of the Palnis and it is also fairly common on the open grass lands of the High Range in Travancore. Ferguson also records (J.B.N.H.S., xii, 203) that he had a specimen from Ponmudi in South Travancore.

The breeding season according to Terry, Davison and Betham is in April and May.

### **Anthus similis similis** Jerdon.

*Anthus similis* Jerdon, Madras Jour. Lit. Sci., vol. xi (1840), p. 35—South India = Jalna.

The Rufous Rock-Pipit is a somewhat scarce resident on the Nilgiris where it is confined to open slopes and high plateaux and escapes observation by its shyness. Hume (S.F., i, 203) says that it also occurs in the Palnis and Anamalais and in Travancore Ferguson obtained a single specimen at Ponmudi in August 1900 at 3,500 ft.

Eggs were taken in the Nilgiris by Miss Cockburn in March and May.

There is a certain amount of difficulty about the correct name of the Rufous Rock-Pipit and this has not been cleared up by the very confused discussion of it in the *New Fauna*, vol. iii, p. 284.

The first name to be given to any member of this group of subspecies in India was *Anthus similis* Jerdon, Madras Jour. Lit. Sci., vol. xi (1840), p. 35. The description accurately indicated this species but was not sufficiently detailed to show which of the three closely allied Indian subspecies was meant. The type locality was not clearly indicated but he said 'I only once observed this large Titlark in an open stony plain, there were a pair of them together and I noticed that their flight was performed somewhat differently to that of the Titlarks in general, there being a more frequent flapping of the wings'.

The type locality is however clearly settled by Jerdon's later statement in his Illustrations of Indian Ornithology, pl. xlv (1847), where he says 'my first specimens were procured at Jalna in the neighbourhood of low hills on a bare plain'. The fact that he then figured the dark Nilgiri bird and remarked 'I have since, on several occasions, seen it on the Segoor Pass of the Neelgherries among rocky ground about 4,000 ft. high' no more makes the type locality the Nilgiris than his idea that it also probably occurred in the Himalayas could transfer the type locality northwards.

The actual type specimens are not known to exist. We have, therefore, to decide whether the bird that Jerdon met at Jalna is more likely to have belonged to the Himalayan, Baluchistan or Nilgiri races. Both the northern forms wander southwards in winter as far as the Bombay Presidency, so either might easily occur at Jalna. At the same time the Nilgiri bird might easily be found as far north. There is a single male specimen (not specimens as Mr. Stuart Baker says) in the British Museum collected by Fairbank on 30-12-74 on the Imampur Ghat near Ahmednagar (S.F., iv, 260), and Captain Gosse obtained a female with 3 eggs on the Two Sister's 2,300 ft. near Poona on 11th August. This bird we have carefully examined and can only attribute to the Nilgiri form. As Jerdon's pair were evidently displaying the obvious inference would seem to be that *Anthus similis* of Jalna must be the Southern form. Against that inference however we must set the fact that Jerdon later in 1863 (Birds of India, vol. ii, p. 236) when he had recognised that the Himalayan and Nilgiri birds were distinct expressly attributed his original Jalna specimens to the Himalayan form, though there is nothing to show whether they were still available for comparison. Identification of these races by memory would not be trustworthy.

In face of these difficulties it would have been better to reject the name *Anthus similis* Jerdon as unrecognisable had only a subspecific name been at issue. The issue is however wider. The specific name for this group of pipits, which includes various African members, is given in the *New Fauna* as *Anthus sordidus* Rüppel, Neue Wirb., Aves (1835), p. 103—Abyssinia. This cannot, however, be used since, as Friedmann has pointed out (Proc. Biol. Soc. Wash. 1932, p. 164) that name is preoccupied by *Anthus sordidus* Lesson. Chili. Voy. Coquelle Zool., i (2) 1831, p. 644 = *Lessonia rufa rufa* (Gmelin). Friedmann suggests that *Anthus nicholsoni* Sharpe, Layards Birds, S. Africa (1844), p. 536, is the next oldest name but he has apparently overlooked both this *Anthus similis* Jerdon (1840) and also *Anthus jerdoni* Finsch. 1870, Tr. Z. S., p. 241. *Anthus similis* Jerdon must clearly be used for the specific name of the group even if it is not clearly recognisable subspecifically. Under the circumstances I propose to restrict the name to the South Indian breeding bird and use *Anthus cockburniæ* Oates, *Fauna, Brit. Ind.*, Birds, vol. ii (1890), p. 305—Nilgiris, Coonoor, as a synonym.

### **Anthus richardi** Vieillot.

*Anthus richardi* Vieillot, Nouv. Dict. d'Hist. Nat. nouv., ed., 1818, vol. xxvi, p. 491—France.

Specimen collected:—1279 ♀ 20-1-30 Godaveri Delta.

Measurements:—

| Bill. | Wing. | Tail. | Tarsus. |
|---|---|---|---|
| 16 | 90.5 | 75 | 30 mm. |

One cannot consider as very satisfactory the account of Richard's Pipit in the *New Fauna* (iii, p. 289):—'common all down the east coast to Ceylon, west it has been found as far as the Sutlej Valley, but has not been recorded from the Bombay Presidency or further South on the West Coast'.

Richard's Pipit is a well known and common winter visitor to the eastern part of the Indian Empire from Assam and lower Bengal to Tenasserim. It also is common in the Andamans and in Ceylon (which it may perhaps reach via the Andamans) it is found from October until May. I can find no authority at all for the statement that it is common all down the east coast of India. There are indeed only three records for that side south of Lower Bengal, viz., Ball's inclusion of it in his list of Nowaghar and Karial birds 1876-1877 (S.F., vii, 220), the above Survey specimen, and the fact that a specimen obtained in Chingleput is said to be in the Madras Museum.

In the Nepal Valley Scully found it a rather scarce winter visitor (S.F., viii, 316) and there are one or two records from Bihar and the United Provinces. The statement that it occurs in the Sutlej Valley is due to Stoliczka but I am by no means certain that that record was not due to confusion with *A. s. jerdoni.* Be that as it may, and there are no records for the Punjab, Sind and Rajputana, Richard's Pipit has been recorded far further west at Kohat (Whitehead, Ibis 1909, p. 243) and two specimens collected there on 4-1-06 and 14-2-08 are in the British Museum. Captain Whitehead later obtained it at Sehore on 22 May (J.B.N.H.S., xxii, p. 156—specimen in the British Museum), though the record for Mhow (J.B.N.H.S., xxxv, 393) is based on a misidentification of *A. r. thermophilus*.

In the Bombay Presidency it has been recorded by James Davidson—two specimens obtained at Honawar in January 1890 (J.B.N.H.S., xi, 674). Further south on the west there are specimens in the British Museum from Coorg

(Tweedale Coll.), Kotagiri (♀ 17-10-70 Cockburn), Slope of the Nilgiris (♂ March 1877 Hume Coll.), and two Anjango specimens in the Hume Collection. Colonel H. R. Baker also obtained a male at Cannanore on 24-2-10 and this specimen is now in my collection.

This fine Pipit is a confirmed wanderer. It has been recorded over 80 times in the British Isles and it may be expected to occur casually in any part of India though its true winter quarters lie further to the east.

I have left the name binomial as I have considerable doubts whether Richard's Pipit is to be considered as having any races. *Anthus thermophilus* Jerdon (=*striolatus* auct.) is now said to be a race of *campestris* (vide Kozlova, Ibis 1933, p. 83). *Anthus rufulus* and allied forms in Asia and Africa are best treated as a separate group. I am unable to recognise *Anthus richardi centralasiae* Kistiakowsky, Works of the Ukraine Academy of Sciences, vol. vi, no. 3 (1928), p. 551—Nanshan, for Madame Koslov (*loc. cit.*) has shown that the supposed colour differences do not hold good and whilst she is inclined to agree to a slight difference in size my own researches show that that is also non-existent.

### **Anthus campestris thermophilus**[1] Jerdon.

*Corydalla thermophilus* Jerdon, Birds of India, vol. ii (1863), p. 233 (ex. Hodgson *nom. nud.* quoted as synonym of *Corydalla striolata*)—Nepal.

Mr. Stuart Baker throws considerable doubt on the validity of Blyth's Pipit as a good form (*New Fauna,* vol. iii, p. 289) and says that the only difference between it and Richard's Pipit consists in the length of the hind claw. The matter cannot be satisfactorily cleared up until a series of Blyth's Pipit is available from its breeding quarters but in the meantime I personally find no difficulty in accepting the distinction in size made in the *Old Fauna* (vol. ii, 308) which is most easily recognised from the tarsus. Witherby gives the length of the tarsus in the male Richard's Pipit as 31-32 mm. (Prac. Handbook, i, 173) and I find that 12 males from Central Asia, taken at random, give a tarsus length of 29.5-33 mm. I have not been able to examine such a satisfactory series of females but in that sex also the tarsus is evidently as a rule 30 mm. or longer.

Fifteen supposed *thermophilus* of both sexes, on the other hand, yield a tarsial length of 25-28.5 mm. and if this difference can in due course be shown to be correlated with a distinct breeding range it must certainly be recognised. According to Stegman and Madame Koslov who have studied the various breeding ranges *thermophilus* is to be considered a race of *campestris* and not of *richardi*.

Accepting *thermophilus* as a good form, therefore, I find the following records for the Presidency. Jerdon (Birds of India, ii, 234) says that he procured it in the Nellore district, generally near low bushy hills. Ferguson says that it is a winter visitor to Travancore, found in fairly large numbers in February and March in the dry paddy fields after the crops have been cut. A male collected at Coimbatore on 9-10-68 by A. G. R. Carter, a female from Kotaghery collected by Miss Cockburn on 17-10-70 and a third bird from the slopes of the Nilgiris, March 1877 are in the Hume Collection in the British Museum.

Blyth's Pipit is not nearly so widely distributed in India as Mr. Stuart Baker implies. There is no record for the N.-W.F.P., Baluchistan, Punjab, Sind or Rajputana.

### **Anthus rufulus rufulus** Vieillot.

*Anthus rufulus* Vieillot, Nouv. Dict. d'Hist. Nat., nouv. ed., vol. xxxvi, (1818), p. 494—Bengal.

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[1] This name cannot really be used as it had already been quoted as a synonym of *A. rufescens* of Temminck. No other name appears to be available and I hesitate to give one in view of my doubts as to the validity of this form.

Specimens collected:—230-238 ♂ ♀ ♀ ♀ ♂ ♂ ♂ ♀ ♀ 16-5-29 Shevaroy Hills 5,400 ft.; 680 sex? 12-8-29 Palkonda Hills 500 ft.; 1119 ♂ 16-12-29 Cumbum Valley; 1192 ♂ 1195 ♀ 6-1-30, 1199 ♂ 7-1-30, 1211-2 ♂♂ 1215 ♀ 9-1-30, 1224 ♂ 11-1-30, 1238 ♀ 13-1-30, 1261 ♀ 16-1-30, 1268-1270 ♀♂♀ 1234 ♂ 19-1-30, 1277 ♂ 20-1-30, 1296 ♀ 23-1-30, 1306 ♂ 1308 ♀ 25-1-30, 1312-3 ♂♀ 26-1-30 Godaveri Delta; 1689 ♀ 16-4-30, 1706 [♂] 19-4-30 Jeypore Agency 3,000 ft.

Measurements:—

| | Bill. | Wing. | Tail. | Tarsus. |
|---|---|---|---|---|
| 15 ♂ | 15-17.5 | 79-85 | 54-62 | 24-27 mm |
| 15 ♀ | 15-16.5 | 76.5-81 | 53-56.5 | 25-26 mm. |

Dewar states that the Indian Pipit does not seem to be very common at Madras. With that exception the whole of the records for the Eastern side of the Presidency are supplied by the above series collected by the Survey. La Personne remarks that they were common on the grassy hill tops of the Shevaroy Peak 5,400 ft. where they were breeding under the low scrub that clothed the summit. They were also found breeding commonly in the Godavery Delta.

On the western side there is much more information about it. In Coorg it is a common resident, breeding wherever there is open grassland (Betts). In the Brahmagherries, the Wynaad and the Nilgiris it is very common (William Davison). In the last named Mr. Betts informs me that it replaces the Nilgiri Pipit on the lower hillsides, wherever they are sufficiently open and grassy. Kinloch found it on the Lily Downs of the Nelliampathies about 4,700 ft. Fairbank obtained it at the base of the Palnis and at 4,000 ft. in these hills. In Travancore (Ferguson) it is resident and very numerous in the low country in the dried paddyfields and also on open grassy ridges in the hills at all elevations.

Nothing appears to have been recorded about the breeding season in the Presidency. From the careful notes about the state of the organs on the labels of the fine Survey series it is evident that in the Godavery Delta the birds were laying about the middle of January and in the Shevaroy Hills they were breeding in May.

Ticehurst has already pointed out (J.B.N.H.S., xxxii, p. 352) that the *New Fauna* is wrong in extending the typical race of this Pipit to Ceylon and we agree with him that the island birds must be attributed to the race *malayensis*. We are not yet satisfied as to the subspecific identity of the birds of the western side of the Presidency but hope to return to this point in the report on the Travancore Survey.

### **Alauda gulgula australis** Brooks.

*Alauda australis* Brooks, S.F., i (1873), p. 486—Ootacamund.

Specimens collected:—1190 ♂ 1193 ♂ 1197 ♀ 6-1-30, 1198 ♂ 1200 ♂ 1202 ♂ 7-1-30, 1213-4 ♂♂ 9-1-30, 1223 ♂ 1225 ♂ 1227-8 ♀♂ 11-1-30, 1236 ♂ 1239 ♀ 1240 ♂ 1242 ♂ 1244 ♂ 13-1-30, 1257-8 ♂♂ 1260 ♂ 16-1-30, 1264 ♂ 1267 ♂ 1272 ♂ 19-1-30, 1280-1 ♂♂ 20-1-30, 1307 ♂ 25-1-30, 1311 ♂ 26-1-30 Godaveri Delta.

Measurements:—

| | Bill. | Wing. | Tail. | Tarsus. |
|---|---|---|---|---|
| 24 ♂ | 14-16 (once 13) | 87-93 | 49-56 | 22.5-26 (once 21.5) mm. |
| 3 ♀ | 13-14.5 | 84.5-85.5 | 48.5-50 | 22.5-24.5 mm. |

From the organs of the above series it was evident that they were breeding, and Mr. La Personne moreover remarks that they were breeding freely on the sandbanks opposite Dowlaisheram, the nests being built under tufts of grass about 3 feet from water, usually on damp soil.

No other skylarks were obtained by the Survey and on the eastern side of the Presidency the only other record is Dewar's statement that the skylark is common at Madras.

On the west the Indian Skylark is far better known. Although less abundant in the Wynaad it is according to William Davison and others very common all over the grassy downs of the Nilgiris. Here, Mr. Betts informs me, it breeds in April and May and again after the monsoon, in September and October. Terry found nests at Pulungi and Pittur in the Palnis in April and considered it common on the tops of bare rocky hills. In Travancore Ferguson says that it is common on the High Range and he also met with it in the plains.

It is with great hesitation that I have referred the above series of skylarks to *A. g. australis*. They are certainly smaller than the few Nilgiri specimens which I have been able to examine, but my series from the latter range is not large enough to settle this point satisfactorily. I hope to obtain more material in time to return to the question in connection with the Travancore Survey.

### **Calandrella brachydactyla dukhunensis** (Sykes).

*Alauda dukhunensis* Sykes, P.Z.S. 1832 (July 31), p. 93—Dukhun.

Specimens collected:—1271 ♀ 19-1-30, 1294 ♂ 23-1-30, 1316 ♂ 26-1-30 Godaveri Delta.

Measurements:—

| | Bill. | Wing. | Tail. | Tarsus. |
|---|---|---|---|---|
| 2 ♂ | 13-13.5 | 100-101 | 59.5-60 | 20.5-21.5 mm. |
| ♀ | 13 | 92 | 51 | 20 mm. |

These three specimens provide the only records of the Rufous Short-toed Lark within the Presidency. This race of Short-toed Lark appears to be confined in winter in India to an area lying east of a line through Etawah, Mhow and Khandesh and north of another line from North Kanara to the Godavery Delta. The implication in the *New Fauna* (vol. iii, p. 326) that it occurs in North-West India is not supported by any evidence except a specimen in the Hume Collection obtained by Dr. Day at Karachi on 21-10-71 of which the identification is doubtful and not accepted by Ticehurst (Birds of Sind, Ibis and J.B.N.H.S., xxxii, 353).

### [**Mirafra javanica cantillans** Blyth.

*Mirafra cantillans* Blyth, J.A.S.B., vol. xiii (after December 1844), p. 960 ex J.A.S.B., vol. xii (1843), p. 181 *nom nud;* ex Jerdon, MS.—Bengal.

The status of the Singing Bush-Lark in the Presidency is not very clear. Jerdon informs us that it is most abundant in the Carnatic and the Northern Circars and the *New Fauna* states that it is found down to Travancore on the west, but no corroboration of Jerdon's statement was found by the Survey and the bird does not occur in Ferguson's Travancore list. Nor have I traced any other record for the Presidency].

### **Mirafra affinis** Jerdon.

*Mirafra affinis* Jerdon, Madr. Jour. Lit. Sci., xiii, pt. 2 (1844-1845), p. 136—Goomsoor in Ganjam.

Specimens collected:—7 ♂ 9-4-29, 9 ♀ 18-4-29, 43 ♂ 13-4-29, 61 ♀ 16-4-29, 75 ♂ 17-4-29, 123 ♀ 24-4-29, 126 ♂ 25-4-29 Kurumbapatti; 298 ♂ 31-5-29, 309 ♀ 2-6-29, 376-377 ♂♂ 11-6-29, 386 ♀ 12-6-29, 395 ♀ 13-6-29, 418 ♂ 15-6-29 Chitteri range 2,000-3,000 ft.; 443-444 ♀♂ 18-6-29 Harur 1,000 ft.; 454 ♂ 20-6-29, 465 sex? 23-6-29 Tirthamalai 1,000 ft.; 484 ♀ 2-7-29 Trichinopoly; 503 ♂ 509-510 ♂♀ 4-7-29 Kalai; 534-535 ♂♂ 8-7-29 Vyampatti Trichinopoly; 550 ♂ 18-7-29, 577 ♀ 22-7-29, 588 ♂ 23-7-29 Gingee; 746 ♂ 24-8-29, 751 ♀ 752 ♂ juv. 758 ♀ 759 ♂ 26-8-29, 760 ♂ juv. 761 ♂ 27-8-29 Palkonda Hills 5,000 ft.; 809 ♂ 810 ♂ 12-9-29, 820 ♂ 822 sex? 17-9-29, 835 ♂ 838 ♂ 20-9-29 Kodur; 867 ♂ 870 ♀ 3-10-29, 914 ♂ 13-10-29 Seshachalam Hills 2,000 ft.

Measurements:—

| | Bill. | Wing. | Tail. | Tarsus. |
|---|---|---|---|---|
| 25 ♂ | 14.5-17.5 | 77-88 | 43-50 | 23.5-27 mm. |
| 13 ♀ | 13-17 | 75-82 | 38.5-45 | 24.5-28 mm. |

The Madras Bush-Lark according to Jerdon occurs as far north as Gumsoor in Ganjam and Midnapur and the former is the type locality. The only specimen that I have been able to examine from as far north is one collected by Colonel Walton at Samol, Jalchar, Orissa (Bombay Society's Museum) and there appears to be no other record until the Godavery valley is reached, a specimen from near Ellore being in the Hume Collection. The fine series collected by the Survey proves that this lark is very generally distributed both in the plains and in the hills up to 5,000 ft., from Kodur and the Seschachalam Hills down to the Cauvery River, and doubtless on to Cape Comorin and the bases of the Travancore ranges. On the west it is less well known. A specimen was collected by Col. H. R. Baker at Cannanore on 29 May 1910. There are two specimens from Coorg in the Tweedale Collection. William Davison tells us that it occurs round the base of the Nilgiris but the only specimens I have seen are a female collected by Col. Sparrow at Goodalore on 1-4-1914 and a male in the Hume Collection collected by Dr. Day on 1-1-1873 at Coonoor. In Travancore, according to Ferguson, it is common in the plains, where it occurs in the grasslands, sometimes in flocks and sometimes solitary.

The breeding season has not been accurately recorded. The organs of the Survey series suggest that it extends from about April to July on the eastern side and Ferguson took a single egg in Travancore on 26 April. Young birds obtained by the Survey in August resemble the adults. The feathers of the upper parts have pale fringes producing the scale marking characteristic of most juvenile alaudidae; the pale chestnut edges to the wing coverts, and wing and tail quills are proportionately broader than in the adult and on the primaries extend also round their tips.

The Madras Bush-Lark can certainly not be considered a race of *Mirafra assamica*. The change in colour is too abrupt and striking and hardly likely to be correlated with the reappearance of the dark *affinis*-like form *microptera* in Burma. It must either be treated as a separate species or as a race of *Mirafra erythroptera* the Red-winged Bush-Lark. From this it differs:—

(1) Size: larger with a proportionately larger bill and shorter tail. 18 males of *M. e. erythroptera* measure bill 13-15, wing 76-84, tail 47-55 mm.

(2) The upper parts are darker, with the dark centres of the feathers proportionately larger; lower parts darker, more buff, less creamy.

(3) The chestnut on both webs of the primaries is less extensive, being divided along the shaft by a long dark distal wedge, whereas in *erythroptera* the whole of the basal two-thirds of the feather is chestnut, the shaft alone being dark brown.

(4) The inner secondaries are dark brown merely edged with chestnut, whereas in *erythroptera* they are usually completely chestnut.

These differences are merely those of degree such as one finds amongst subspecies and intermediate specimens are certainly found. Moreover the ranges of the two forms are largely complementary in the Peninsula. I have plotted out the records of both forms on a map and find they are only said to coincide in certain areas near the junction of the two distributions. These areas are Chota Nagpur (Singhbhum: Mannbhum), Hyderabad State, Belgaum and N. Kanara, Manzeerabad, Mysore and Cannanore. Some of these coincidences can I think be dismissed as erroneous, based on old and faulty identifications, and the only one substantiated by specimens is that of Hyderabad. In Hyderabad both Colonel Sparrow and Mr. Salim Ali undoubtedly obtained both forms in the south-east of the State as has been narrated in detail in the Hyderabad Survey. I expect that further observation in this area will show that either both forms occur in different terrain, as Jerdon expressly stated to be the case when he met *Mirafra erythroptera* 'once only in the Carnatic at the foot of the Eastern Ghats inland from Nellore' (B. of I., ii, 419) or that there is some seasonal wandering.

[Except for the above statement by Jerdon there is no reason to admit *Mirafra erythroptera erythroptera* to the Presidency list. Colonel H. R. Baker states (Birds of S. India, p. 120) that he obtained it and its nest during the monsoon at Cannanore. This specimen duly labelled *M. erythroptera* 29 May Cannanore is still in his collection, which I purchased about 1925-1926, but it is a specimen of *M. affinis*.]

*Alauda coromandeliana* Pucheran ex Cuvier MSS., Revue Mag. Zool. 1854, p. 63, based on a specimen obtained by Leschenault in 1819 at Pondicherry is a synonym for this race.

### **Galerida malabarica** Scopoli.

*Galerida malabarica* Scopoli, Del. Flor. et Faun., Insubr., vol. ii (1786), p. 94—Malabar Coast.

Not obtained by the Survey. The Malabar Crested Lark is confined to the western side of the Presidency.

A female collected by Dr. Day at Mangalore on 23-4-1873 is in the British Museum and another female collected by Col. H. R. Baker on 11-8-1910 at Cannanore is in my own collection. Two males collected by William Davison near Manantoddy, Wynaad, on the 5th and 12th April 1881 are also in the British Museum. Mr. Betts informs me that it is common in Coorg wherever there is open country, gathering in flocks out of the breeding season.

In the Nilgiris, according to Davison, it replaces *Galerida deva*, which is the lark on the low country on the Mysore border. It is not uncommon on the plateau, frequenting the grassy hills in pairs and small parties, and in the main it is certainly resident though Davison relates how on 23 May he met a flock of some 30 birds, unsettled as if on passage, a few miles from Gundalopet in Mysore.

In Travancore Ferguson says that it is only found on the High Range at 6,000 ft., where it is fairly abundant and goes about usually in small flocks.

In the Nilgiris according to Miss Cockburn the Malabar Crested Lark breeds twice a year in March and April and again in August and September. Colonel Sparrow informs me that he took 2 nests with eggs in the Cardamum Hills in March.

It seems hard to believe that Sykes' Crested Lark *Galerida deva* (Sykes) should not be treated as a race of this species. The differences of colour and size in the two forms might easily be merely subspecific and in the main the ranges of the two forms are complementary, *malabarica* being confined to a narrow strip along the west coast from Ahmedabad to Travancore whilst *deva* is widely spread in the centre of the Peninsula. There seems however to be no doubt that both forms occur in Ahmedabad, Nassick, Belgaum and S. Mysore. Careful field work in the future may show that these coincidences are compatible with two subspecies, but in the meantime it is safer to treat both forms as species.

### **Ammomanes phoenicura phoenicura** (Franklin).

*Mirafra phoenicura* Franklin, P.Z.S. 1830-1831 (25 October 1831), p. 119—Between Calcutta and Benares and in the Vindhyan Hills between the latter place and Gurra Mundela.

Specimens collected:—530-531 ♂ juv., o? juv. 7-29 Kalai, Trichinopoly; 930 ♀ 18-10-29 Seschachalam Hills 2,000 ft.; 1043 ♂ 1046-7 ♂♂ 5-12-29, 1048-1051 ♂♂♀♂ 6-12-29, 1053 ♂ 7-12-29, 1087 ♀ 1090 ♂ 11-12-29, 1103 ♂ 13-12-29, 1131 ♀ 17-12-29, 1137 ♂ 18-12-29, 1157 ♀ 22-12-29, 1181-2 ♂♂ 27-12-29 Cumbum Valley.

Measurements:—

| | Bill. | Wing. | Tail. | Tarsus. |
|---|---|---|---|---|
| 12 ♂ | 15.5-17.5 | 104-110 | 58-63 | 21.5-23 mm. |
| 5 ♀ | 15-16 | 99-103 | 52-59.5 | 20.5-23 mm. |

The Rufous-tailed Finch-Lark is evidently confined to the drier parts of the Presidency as a resident species. In addition to the three localities in which it was obtained by the Survey in the Cumbum Valley, the Seschachalam Hills and Trichinopoly I can only trace a single record for our area, namely a female in the Hume collection obtained by A. G. R. Theobald at Coimbatore on 10 October 1868.

The organs of the Cumbum Valley series suggest that they would have bred in the early part of the year.

### **Eremopterix grisea grisea** (Scopoli).

*Alauda grisea* Scopoli, Del. Flor. et Faun., Insubr., vol. ii (1786), p. 95—Ginge, South Arcot District, India.

Specimens collected:—483, 485 ♂ ♀ 2-7-29 Trichinopoly; 496 ♀ 498 ♂ 3-7-29, 500 ♂ 4-7-29 Kalai; 592-3 ♂♂ 24-7-29 Gingee; 800 ♀ 10-9-29, 821 ♂ 17-9-29 Kodur; 1047A ♂ 6-12-29, 1052 ♂ 1054-1057 ♂♂♂♂ 7-12-29, 1061-2 ♂ ♀ 1064-5 ♂ ♀ 8-12-29, 1070 ♂ 1072 ♀ 9-12-29, 1092 ♀ 12-12-29, 1104 ♂ 13-12-29, 1116 ♀ 15-12-29, 1163 ♀ 1168 ♂ 23-12-29, 1194 ♀ 6-1-30, 1201 ♀ 7-1-30, 1273 ♀ 19-1-30, 1276 ♀ 20-1-30 Cumbum Valley; 1191 ♂ 6-1-30, 1226 ♂ 11-1-30, 1237 ♂ 13-1-30, 1259 ♂ 16-1-30, 1265 ♂ 19-1-30, 1319 ♂ 29-1-30 Godavery Delta.

Measurements:—

| | Bill. | Wing. | Tail. | Tarsus. |
|---|---|---|---|---|
| 24 ♂ | 10.5-13 | 74-78 | 39.5-46 | 14-16 mm. |
| 13 ♀ | 11-12.5 | 71.5-77.5 | 37-42.5 | 14.5-16.5 mm. |

There is no record of the Ashy-crowned Finch-Lark in the Presidency north of the Godaveri River but southwards it is evidently so common and so generally distributed that there is no need to cite the various records. It is however confined to the plains and does not ascend any of the hill ranges. It occurs on Rameswaram Island.

The few breeding records suggest that individual birds may nest at any time of the year. Theobald found a nest with 3 eggs at Salem on 21 August (N. & E., ed. 2, vol. ii, p. 245); Terry found a nest on the roof of a godown at Bellary in December (*loc. cit.*, p. 246). The organs of the Survey series suggest that some birds were breeding about Trichinopoly in July and in the Cumbum Valley in December and January. Captain R. S. P. Bates informs me that it breeds from February onwards until the rains and gives me an interesting account of how in June at St. Thomas' Mount he found 4 nests within 130 yards, of which two were only four paces apart.

Owing to the courtesy of the Director of the Colombo Museum I have been able to examine a fine series of 12 males and 5 females of this lark from Ceylon. These undoubtedly differ from the typical form in the slightly longer and much heavier bill which approximates to that of *Eremopteryx frontalis* (*melanauchen* Old Fauna). As a large bill is an oft-recurring characteristic of the insular races in Ceylon, I think it should be emphasised again in this case by the bestowal of a name and I therefore propose the name

EREMOPTERIX GRISEA CEYLONENSIS subs. nov.

*Type*:—♂ ad. 11 January 1922, collected by G. Brown, 8 miles north of Paletupani East Coast, Ceylon (H. Whistler Coll.).

***(To be continued).***

# SOME NOTES ON BISON (*BIBOS GAURUS*) IN BURMA

BY

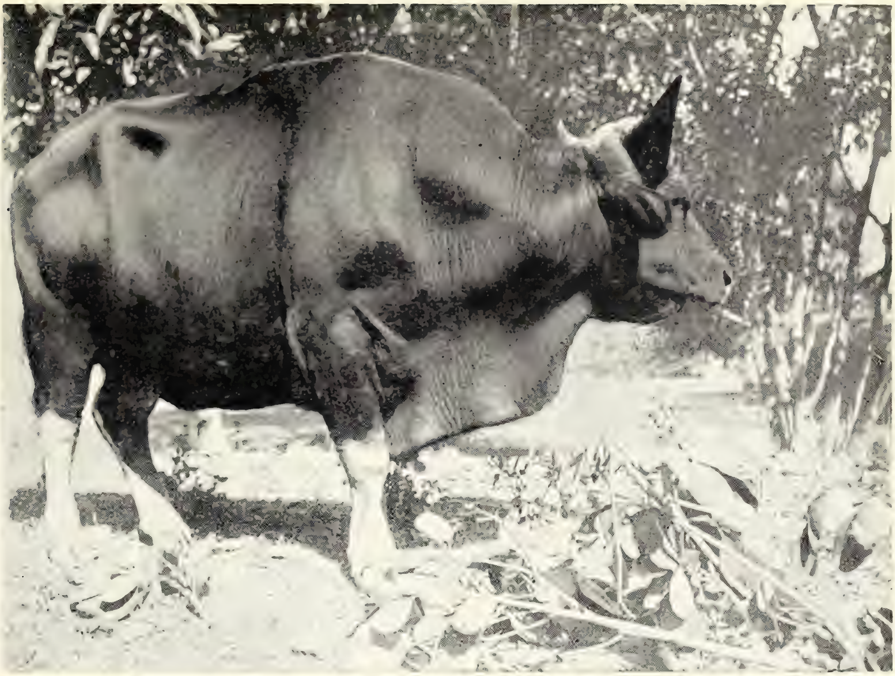
W. S. THOM, I.P. (*Retd.*).

(*With two plates*).

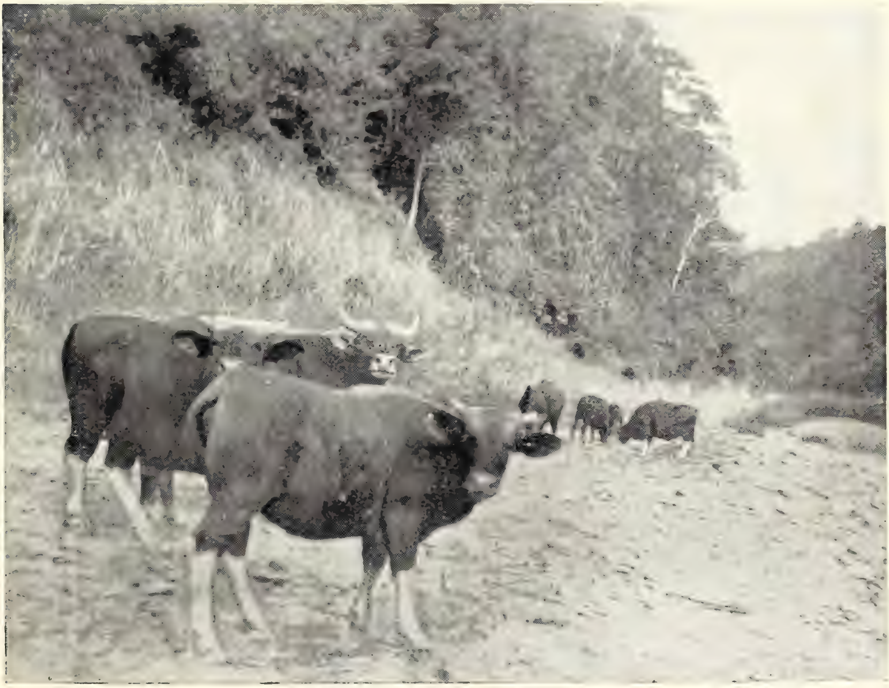
No one who has followed and shot a solitary bull Gaur, or Bison, as he is usually called, can fail to be impressed by his immense size, noble appearance, and magnificence of the trophy obtained. Neither can he deny that the sportsman in Burma will, on occasions, in encounters with these animals, obtain all the thrills and excitement he can possibly desire, and, had I not said in a previous article in the *Journal* that I considered elephant shooting the grandest of all sports, I might, on reflection, have reversed that decision in favour of bison shooting.

My own experience over a course of 45 years of the jungles of Burma has shown me that no more dangerous animal is to be met with in the jungle in any part of the world, except, perhaps, a wounded tiger, boar, or lion, than an old wounded bull bison standing between 19 and 21 hands at the shoulder. Bison are indeed the largest of all the oxen in the world and stand, if I mistake not, higher than the biggest cart horse that was ever foaled. Woe betide the sportsman who, when following up a wounded bull bison, especially in the dense forests of Burma, fails to stop him in his charge, when, with head down he comes tearing along with great strides bent on demolishing everything in his path. To say that a Tsaine or Banting (*Bibos sondaicus*) is a more dangerous animal to tackle than a bison when wounded or otherwise, is quite incorrect. A bull Tsaine is certainly more active, and more alert, and has better hearing and sight than a bull bison but he is not nearly so dangerous. Bison as a rule stand higher in Burma than they do in any other part of the world, and also have finer heads than are obtainable elsewhere. The true bison is the American animal, so to speak of the gaur as a bison is a misnomer although for the purposes of this article I shall refer to it as a bison. The sportsman and his hunters will require not only to exercise every atom of the skill and woodcraft possessed by them to avoid fatal mishaps occurring when tracking down old solitary bull bison, but a good rifle is also a *sine qua non*.

Nothing smaller than a 577, 500, or 470 bore cordite rifle should, in my opinion, be used on these big animals. In fact I would recommend the use of one or other of these rifles on all large and dangerous game such as elephant, bison, tiger, rhinoceros, buffalo, and tsaine, when you have to meet them on an equal footing, that is to say on foot and not when you are up a tree in a machan, or on the back of an elephant where you are in a comparatively safe position, and can afford to take risks and experiment with rifles of smaller calibres than those referred to above. It is all very well for the experienced sportsman who



1. The Gayal or Mithun (*Bibos frontalis* Lamb.).



2. A herd of Bison (*Bibos gaurus* H. Smith) at a Salt-lick.

considers himself to be a good shot and thinks he can place a bullet in the body of an animal in a fatal spot with his first shot nearly every time, and uses in consequence weapons of calibres such as 256, 280, 318, 375, 400, or 423. Such men, in my opinion, would set a bad example to the beginner when the latter essays out after big game, were they to suggest to him that he should start using one or other of the above mentioned weapons instead of recommending him to start his novitiate with a really reliable weapon such as a 450 or 500 bore cordite rifle burning charges of 70 or 80 grains of cordite. There are far more indifferent shots and beginners in this world, than there are experts, so far as big game shooting is concerned.

A bull bison shot through the intestines is a devil incarnate for at least four, or even five days, until peritonitis sets in and carries him off. For such bulky animals, bison can cover the ground when in full charge at a great pace and nothing but a heavy bullet with a big powder charge behind it of at least 80 to 100 grains of cordite placed in the vertebrae, or the brain of the animal, will stop them on these occasions. Some men who have had the luck to shoot two or three bison dead with one shot each on first going out after these animals with, say, a powerful small bore, such as a magnum 375 or a 318, make little of bison shooting in consequence, and imagine that these animals are easily disposed of. These men cannot, however, by any manner of means be permitted to be judges and until they have gone through the mill and have had the pleasure and experience of following up wounded solitary bulls, they can know nothing about it. 'But why wound an animal at all', I hear some one say, 'and have to follow him up and risk a charge, ' 'why not hold straight in the first instance'? It is easy, of course to talk like that. I do not profess to be a trained Bisly shot moreover when I have been climbing up and down the steepest hills all day long, through the densest jungles and undergrowth imaginable, with the sweat pouring into my smarting eyes and my skin itching all over like the devil from brushing up against thorns, stinging nettles, hornets' nests, and the hair from the bamboos, it is not always so easy to hold as straight as one would like to. Consequently shots are sometimes badly placed thus necessitating the following up of an animal. There are very few men indeed who have not had to follow up wounded animals during their shikar experiences. Referring to the use of small bore rifles on dangerous game I knew one military Police Officer, P. S. by name, who went after a bull bison armed with only a 303 service rifle with which he had the luck to bag the animal with a single shot through the heart. He remarked to me on his return from his successful venture 'well after that a 303 is good enough for me for use upon any animal'. Another well known sportsman who contributes to the *B.N.H.S. Journal*, had his tensest moment with a tiger armed with only a 280 Ross. It is not what a weapon has done or may do on certain occasions, it is what it will or should do on every occasion and a good 'big un' is far better than a good 'little un'. In Burma one has sometimes to deliver at close quarters a knockdown blow in heavy jungle. This cannot always be done with a small bore rifle. One has to realize what an old solitary bull bison can take sometimes in the way of lead before he has been rendered *hors de combat*, which can only be accomplished by the brain or heart being pierced by the bullet, or the vertebrae of the neck being severed. A shot through the lungs is not necessarily immediately fatal. It depends a good deal on the extent of the damage caused in that region by the bullet. I have known of solitary bull bison getting away and recovering from lung wounds. The brain shot is a difficult one especially when the animal is facing one with its head thrown up. Moreover, one is liable to damage the horns in these cases. It is always well to shoot low when taking the shoulder shot. A novice is likely to be deceived by the size of the dorsal ridge, a shot through which only causes a temporary collapse of the animal, which generally rises and makes off again none the worse. If charged by a bison the only thing to do, unless the sportsman can make certain of his shot, or in case he cannot retreat behind the trunk of a tree, bamboo clump, or rock, in time, is to throw himself on to the ground at full length and chance the beast overstepping him when passing over him in his stride, as happened to me on one occasion (an account of which will be described later on). The animal cannot pull up until he has overshot the sportsman by at least 20 or 30 yards. The bull may, however, turn round again and repeat his charge and hunt the sportsman as a terrier would a rat, and unless he can spring to his feet in time and kill the animal before it reaches him he is in for a 20-foot toss, if he is not badly gored or killed on the spot. An old bull bison has such a short thick massive neck that he is generally unable to lower his horns sufficiently to be able to pick up and toss a human being lying flat on a level piece of ground. To think of escape by running when charged by a bull bison is to court almost certain death. Never approach a bison that may have been floored if its eyes are closed and there is an occasional flicker of the eyelids or ears, as this means that the animal is not dead. Only when the eyes are staring wide open and still can you assume him to be dead. A number of men have been attacked or gored to death through coming too near a seemingly dead bison. Always bombard the body from a safe position with a few sticks or stones before approaching too near or administer a *coup de grace* in the shape of another bullet through the head or neck. With rare exceptions there is no animal in the East, other than the rhinoceros and the tapir which avoids man's proximity more than the bison. The Banting (*Bibos sondaicus*), the true wild cattle of Burma, is usually found nearer villages than bison. The size of a bison can generally be gauged by the size of his hoof marks. I have on several occasions seen tracks very nearly as large as those of a half-grown bull buffalo, although a bison for his size has ordinarily very small hoofs. It does not necessarily follow, however, that large tracks indicate that the owner possesses large horns, for several very large bulls shot by me of over 19 and 20 hands with large hoofs had inferior horns, so what the animal gains in bulk he seems to lose in size of horn. The owners of some of the finest heads shot in Burma had on the whole, small but rather long and wide hoofs. Regarding dewlaps I have noticed that very few bison shot by me had a pronounced dewlap whilst others had only a slight thickening of the skin. A bison's sense of smell is very keen, so stalking them, unless the wind is in one's favour is not easy as some think. The Gayal or Mithun (*Bibos frontalis*) (see Pl. I, 1) is another animal which looks like a bison as he exudes the same oily sweat from his skin and has a very similar odour. The skin, hair and general appearance are almost identical. These hill cattle are kept by the hill people such as the Kamis and Chins solely for sacrificial purposes, and to hand over as dowries by the hill people of the Arakan Hill Tracts, Chin Hills of Burma, Manipur, Assam and elsewhere. They are not used for milch or agricultural purposes. The hill people, as a matter of fact, consider milk a most disgusting fluid and will never use it, quite forgetting, nevertheless, that as babies they were brought up on it. Solitary bull bison in the Arakan Hill Tracts of Lower Burma frequently enter the cultivations and villages of the hill people to consort with the herds of mithun kept by them. I sent a crossbred animal, i.e. half bison and half mithun, from the Arakan Hill Tracts, with four or five pure mithun, to the Rangoon Zoological Gardens some years ago but I am afraid they are not likely to thrive as these animals must have plenty of shrubs and green bamboo leaves and shoots on which to browse. I have watched a bull bison accompany a herd of mithun right up to a village in the Arakan Hill Tracts at dusk and pass the night there with them within 20 or 30 yards of the village. It stayed there the whole night. At daylight, when it would go off to a neighbouring jungle-clad hillside to lie up, invariably joining the mithun again in the morning when these animals turned out to graze in the neighbouring clearings. This particular bull was somewhat of a nuisance for the women drawing water from a stream near by the village used to meet him often. The only notice he took of them, however, was to snort and toss his head at them which caused them to run back screaming to the village. The villagers wanted me to shoot him, but I declined to do so, pointing out to them that the animal was useful, as he was infusing new blood into their herds of mithun. It seems however that the offspring of a cross between a bison and a mithun are a little wild. The hill people find them more difficult to catch when they require an animal to be killed for a feast or for sacrificial purposes even though the usual handful of salt is offered. It is well known all over the Arakan Hill Tracts of Burma that bull bison consort freely with mithun and that the former seem to get accustomed to the presence of human beings to such an extent that they do not make off into the jungle on scenting, or seeing them, but simply slip quietly away and lie up close by.

I suppose that the mithun is a cross between ordinary cattle and bison many generations back out of which has evolved the present species. I have not seen Mr. Stuart-Baker's note on the relationship between bison and mithun, and I have never seen a wild mithun nor have I ever met or heard of any one who had ever seen or shot one. I do not understand, therefore why we are still given licenses to shoot mithun. Is it a jest on the part of the Forest Department? During the past 45 years of my residence in Burma I have on numerous occasions, when in the dense forests of Burma, been seated on the ground surrounded on all sides by bison for fairly long periods studying their habits and the sounds emitted by them, from calves upto full-grown cows and bulls. I have often also sat on the ground in the jungle for many minutes at a time within a few yards of many old solitary bull bison on different occasions, and listened to their deep breathing sounds whilst they chewed the cud, tossed their heads, and swished their tails about from side to side to keep off the flies. Although I must confess to having shot many wild animals in my time, it has always given me the greatest pleasure to be in their midst watching and photographing them and endeavouring to see how near I could get to them without being discovered. Photograph No. 2 (Plate I) depicts a herd of bison at a salt lick partaking of the waters to get rid of internal parasites. All animals, as is well known, visit salt licks for this purpose. In the fly season, that is to say from March to the end of June, these being the hottest months of the year, all large game like elephants, bison, and tsaine are more irritable from the bites of gad flies, mosquitoes, and other flies. At this time they are more dangerous and more on the alert. In order to escape from the bites of flies most animals, such as sambar, bison, elephant, tiger, tsaine and barking deer, prefer to lie up in heavy jungle unless they can find some suitable high open ridge, where a good breeze is blowing. I remember seeing an old solitary bull tsaine in the Momeik State of the Ruby Mines District, Upper Burma, careering along through some fairly open country past me in May, during the hottest time of the day as if the devil were at his heels, seemingly oblivious of my presence, surrounded by a black cloud of gad flies, and shaking his head from side to side in his maddened efforts to get rid of them. These flies are only found in certain dry belts of country where a growth of 'Eng' sal or bastard teak predominates. The bites are most irritating for both man and beast and blood is freely drawn. I remember once having to gallop on horseback fairly quickly through a belt of five miles of similar fly-infested country, referred to in Burma, as 'In' or 'Eng daing', in the Ruby Mines District, in order that my pony and I might escape to some extent the onslaughts of these pests.

I have noticed during the many battles-royal witnessed by me between solitary bull bison on the one hand and between solitary bull tsaine on the other that they as a preliminary to an attack generally approached each other sideways with lowered heads in a half circle pawing the ground occasionally and uttering at the same time half-suppressed snorts or spurts of air from their nostrils and throats. At other times they seemed to draw in their breath making at the same time a low, double, half-suppressed, indrawn guttural sound. The fight generally ended after they had battered each other in a silly sort of way with their horns by one bull chasing the other away and prodding it the while from behind as it made off, in the same way as fights generally end between domesticated buffaloes and ordinary cattle. It was never a fight to death, as often happens between tusker elephants. I have never seen or heard of any fatal encounters between bull bison or between bull tsaine, the reason being, I think, that the horns of these animals especially bison are generally either too curved or too blunt to enable them to inflict a fatal wound whilst their hides are also thick. There is no doubt, of course, that they do gore and injure one another rather badly at times, but these occasions are very rare indeed. The formidable horns of a buffalo are far more likely to inflict a serious wound on the body of an animal. I once came on two bull tsaine hammering away at one another in a duel to such an extent that they did not see my approach till I was within 8 or 10 yards of them. I shot the bigger animal of the two and the other one bolted, but on hearing the death bellow of the dying animal it returned to the attack in spite of my presence and only went off at a slow trot when I shouted at it. On one occasion I came on a herd of bison in the Yoma Mountains on the watershed between Arakan and the Thayetmyo District of Burma away in the blue, that had treed a leopard, which, no doubt, had attempted to carry off a calf. I was attracted to the spot during a short halt for breakfast by hearing at intervals a succession of raucous grunting noises. Agreeing with my hunter, Tha Yauk, that the noises we had heard must have been made by a couple of bears fighting over a nest of bees, I armed myself with a double hammerless 303 rifle and taking Tha Yauk with me went off to reconnoitre. After going some way we came upon bison tracks, and finally some 15 to 20 paces off, burst upon a scene that gladdened my heart, for there on a fork of a large tree, some 15 feet from the ground, was a large leopard snarling like the devil and showing his teeth at intervals, whilst he glared at a circle of bison that stood stolidly round the base of the trunk of the tree pawing the ground with their hoofs and uttering at intervals the low peculiar half suppressed double indrawn guttural sounds, which are usually made by the majority of bovine animals when they are annoyed, and want to fight. No bellows were uttered at all. There is a vast difference between a bellow and the low guttural half-suppressed indrawn sounds referred to, uttered by these animals. The leopard was the first to either wind or see us, for he took a mighty leap from his perch, clear of the bison, his tail swinging round and round in mid air, to enable him to maintain his equilibrium. The herd scattered almost immediately after the disappearance of the leopard without a shot being fired and the jungle became dead and silent once more. It was now apparent that the noises we had heard had been made by the leopard as well as by the bison. Bison have only two enemies to fear, viz. tiger, and man, but the former is no match for a full-grown bull and it is only when a bison feels his end is approaching through old age, disease or wounds, that he succumbs to the repeated attacks of a tiger; but, even then, the latter has usually to put forth all his cunning and his utmost strength before he can hamstring and bring his mighty opponent to the ground. A tiger generally endeavours to hamstring all large bovine animals, such as bison, buffalo and tsaine when he can do it with impunity, although he has a wholesome respect for the horns of a buffalo. When there is a herd of domestic buffaloes about, of course a tiger usually hasn't a look in.

A description of the various sounds and calls emitted by bison may not be out of place here. I will first describe the sounds uttered by a bison when he has been (1) alarmed and (2) when he is at bay. Call No. 1 is the well known startling loud whistling snort of alarm, which is emitted when the beast has either winded or seen a human being. Call No. 2 is a low deep rumbling long-drawn-out menacing note or challenge, which is only sounded when a bull, not necessarily disabled, is standing at bay and means business. There is no mistaking the meaning of the sound as I have heard it on several occasions and it is a warning that the animal is annoyed and will charge on scenting or sighting the hunter. The sound, in fact, is not unlike the low rumble of distant thunder or that uttered by an elephant.

Call No. 3 is a low 'Moo' a kind of note of apprehension, suspicion, or alarm which is uttered, by a bison when he has seen the hunter without winding him or realizing what to make of him. Call No. 4 is a long-drawn-out sonorous roar which is usually uttered by a bull or leader of a herd and is very similar to that emitted by an elephant. Many European sportsmen have been deceived on hearing this roar into believing that it has emanated from an elephant. This call, or roar, for it cannot be called a bellow, is generally uttered by an old bull or leader of a herd as a call, or signal, to its companions that may be resting for the day, that it is time to turn out and feed. The same call, i.e. No. 4, is also uttered by the leader of a herd to bring the herd together when it has been decided to trek for new feeding grounds. On these latter occasions the animals generally go a considerable distance before they settle down and begin feeding again in their new feeding grounds. I remember being within 200 yards or so of a herd of bison one very hot afternoon in April at about 4-30 p.m. My hunters and I had been following the spoor of a bison which, judging by the size of its tracks was a very large animal. The tracks, in fact, looked like those of a buffalo, so large were they. The surrounding jungle was very still and hardly a breath of air stirred the leaves of the trees. My hunters suggested a halt of half an hour before going further in case we should disturb the bull resting. We accordingly pulled up on reaching the bed of the Ru, a stream some 45 yards in width with bushes and undergrowth scattered about along its bed and banks. We had hardly been seated 25 minutes when our ears were greeted by the sound of the snapping of a bamboo from the bank of the stream on our left, some 80 yards off, followed by the appearance of a very large bull bison which suddenly stopped dead, raised his nose slightly in the air, and uttered the well-known, loud continuous sonorous roar or signal. Almost immediately after the reply to the summons came, for we heard the distinct patter on the leaves and twigs of the rapidly moving feet of large animals coming towards us from the opposite side of the stream to our right. Had anyone tried he could not have succeeded in placing us in a better position to witness the whole affair. There was no getting away from the fact that the bull's roar was a signal to the herd which was resting in the jungle on the opposite bank, that it was time for the herd to come out and graze, or that it was a signal that they were about to trek for new grazing grounds. I have often heard this roar used for both purposes. The same call or roar is also used by the leader of a herd to summon any laggards that strayed or remained behind in the grazing grounds when the rest of the herd have moved off from the grazing ground, say at about 8-30 a.m. into the cool recesses of the adjoining jungle to lie up during the heat of the day. The bull almost immediately after uttering his trumpetlike summons became suspicious that things were not as they should be, for he suddenly raised his head and looked fixedly in our direction. My first shot from a 500-bore cordite rifle burning 80 grs. of cordite got him in the neck but failed to stop him as he raced down towards the opposite bank of the stream. The second bullet, however, got him in almost the same place smashing his vertebrae and bringing him to the ground with a crash. He turned out to be a very large animal measuring as accurately as I could take it with a steel tape a little over 20 hands. The head measured 80 inches from point to point, outside measurement, taken straight across the forehead at once, which in my opinion is the best way to measure all the heads of the oxen. A fifth call, or low 'bhay' may occasionally be heard by any observant sportsman who has had long experience of the jungle. This call is usually uttered by a member of a herd that having become separated from its companions, owing to their having been disturbed by human agency, desires to rejoin its companions. This sound is a subdued bellow. It is, in fact, a note which has been made purposely low so as not to attract unduly the attention of its enemy—man. The sound of this 'bhay' never travels very far, not further than perhaps a distance of from 350 to 500 yards at most. With regard to call No. 3, already described, this 'moo' is really one of apprehension, perplexity, suspense, or uncertainty, call it which you will, which is uttered by bison when they have spotted something they have not winded and cannot quite make out. I will give you an instance of this in my own experience. When out with my men on one occasion, on the watershed of the Yoma Mountains between Arakan and Thayetmyo District we suddenly came on a herd of bison that was lying up in the jungle during the heat of the day. A portion of the herd saw us at the same moment, but my men and I allayed their suspicions by throwing ourselves flat on the ground and remaining still. The animals, whose nervousness was quite apparent, although they saw us move, had not winded us. They stood stock-still at first, craning and twisting their necks from side to side in their efforts to try and make out what we were, uttering at the same time at intervals the low husky suppressed 'moo's' referred to above.

Then, when evidently they could stand the tension no longer, some four or five young bulls and cows began to walk slowly towards us in a very hesitating manner, still uttering from time to time low 'moo's', and lowering and raising their heads in an endeavour to get our scent. I have not the slightest idea what they took us for, a tiger perhaps, but when they had approached to within four or five paces of us I thought it time to spring to my feet and stampede them as I did not relish being trampled upon or gored even though they were only young bulls and cows.

Mr. Dunbar-Brander (see pages 151 and 153 of his admirable and popular work *Wild Animals in Central India*) states that bulls bellow with rage. He says 'I had shot a bull in the middle of a grass maidan. The herd bolted a short distance and then returned to their fallen lord. The herd excited and angered at the smell of the blood commenced to bellow and paw up the earth.' The pawing of the earth is a common enough occurrence amongst even domestic cattle but I am of opinion that both the bellowing and the pawing of the ground on this occasion was not due to rage so much as to panic and fear brought on by the smell of the blood and by their desire to be with their stricken leader whose death, moreover, they were unable to connect with the shot whilst they also thought, perhaps, he might yet be able to rise to his feet. It was only after hearing the human voice that they realized the truth. So far as my experience goes, I have never heard of bison bellowing in a rage. I am of opinion, in fact, that they only bellow, as do all domestic cattle when they are in a panic or in mortal fear. I have seen many head of cattle lassoed and thrown to the ground to be castrated, doctored, or branded and in the majority of cases they nearly all bellowed in terror. Then, again, the five mithun and the animal which was the result of a cross between a bison and a mithun, which I sent from Arakan to the Rangoon Zoo some years ago, all bellowed pitifully when they were being hoisted on board ship. A sixth note which may be referred to as being uttered by bison, is the long-drawn-out death call which is uttered by a bull in its death throes. This roar, or death call, is not so loud, prolonged or as sonorous as the roar uttered by the leader of a herd when (1) he asks the herd to come out and feed, when (2) he asks them to trek for new feeding grounds, and when (3) he is calling up the laggards to hurry up and join the rest of the herd and get a move on out of the grazing grounds.

Three large solitary bull bison that I wounded on different occasions waited for me to come up with them after uttering the low long-drawn-out deep rumbling warning notes peculiar to these animals. Old solitary bull bison although they may seem to have lost all sexual instincts are yet found either following the tracks of a herd or in the vicinity of one in the hope of annexing a female sooner or later.

An old man of 75 years of age or over still has sometimes a hankering after the fair sex.

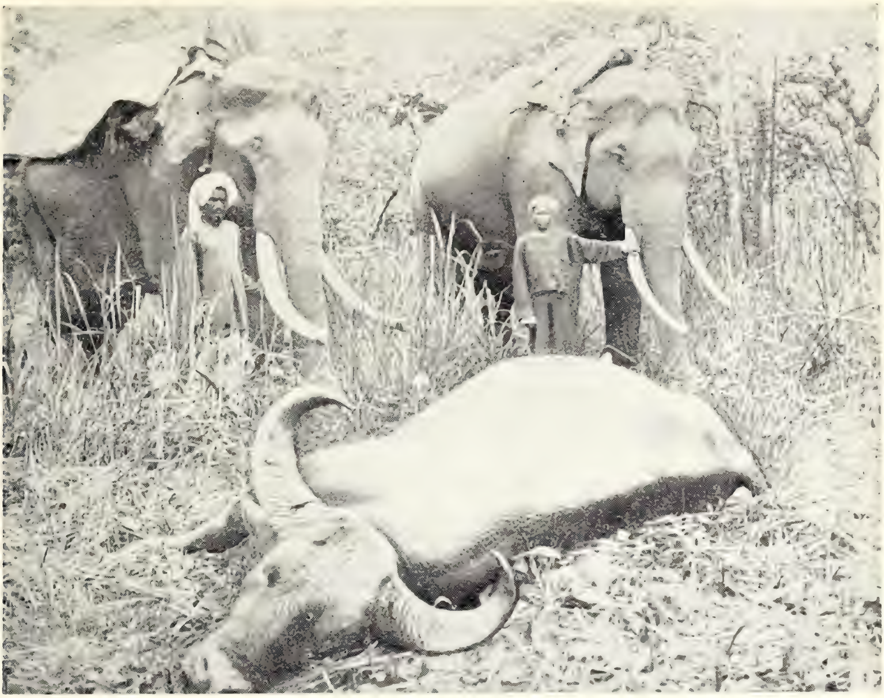
Solitary bull bison occasionally visit remote hill cultivations planted out in paddy and Indian corn as I followed up and shot a very old bull eating the young rice plants in a cultivation situated about 600 yards or so from a Chin village. This village I should state was a long way from other villages. I once came across the largest solitary cow bison with the finest pair of horns for a cow that I have ever seen. My hunter and I examined her very carefully at fairly close quarters through a powerful pair of binoculars and he informed me that she would be dropping a calf in a day or two. My experience goes to show, however, that cow bison drop their calves invariably when with a herd and that the latter as do elephants generally rest for two or three days until the calves are strong enough to move on. This cow through having been disturbed may have become separated from the rest of the herd, but she seemed to be in no hurry and in no way perturbed as she was grazing and moving along quite unconcernedly. To say that solitary bull bison are not given to charging is hardly correct. Solitary bulls in Burma have been known to charge without any provocation whatsoever on sometimes scenting as well as on sighting a human being. Many cases of this kind have occurred in Burma to my knowledge. Mr. King of the Survey of India was recently charged and killed by a solitary bull bison near Taungdwingyi, in the Magwe District. He and a companion apparently, when on duty in the jungle, suddenly came upon the animal, which charged at once in spite of being shouted at. Shouting at some wild animals in an attempt to drive them off is by no means always successful, especially in the case of a solitary elephant. The human voice in some cases often causes an animal to charge, especially in areas where game has been fired at and frequently disturbed. I was once charged by a very truculent old bull bison I was tracking up very cautiously accompanied by a hunter. He came down on us so suddenly through thick stuff from a distance of about 40 yards that I could not see him until he was almost on us. In fact, I had barely time to get out of his way. However after overshooting my hunter and me by about 25 yards, I could see he meant business, for he turned round and came back at us again full tilt. I killed him this time with a lucky shot in the brain.

Some years ago when after bison in the Tavoy District of Lower Burma, along the upper reaches of the Tavoy river beyond a place known as Mijyaunghlang where a morass of hot sulphur springs are to be found, I had an unpleasant experience with an old bull bison which nearly got me. We, that is to say a Karen hunter named Maung Ba Han Tha and I, had just struck the trail of a large solitary bull bison. It was raining at the time. The tracks led into a thicket of low dwarf bamboo jungle into which we cautiously picked our way. The noise of the rain falling on the leaves of the jungle drowned any little sound made by us. It was impossible to see more than 8 or 10 yards ahead. Ba Han Tha was armed with a single-barrelled 8-bore breech-loading gun which burned 8 drs. of powder and carried a heavy spherical ball. I was armed with a double 8-bore rifle, which took a charge of 10 drs. of powder and a heavy conical bullet. We had not gone more than 20 yards into the patch of bamboo when I caught sight of a motionless black patch about the size of a large saucepan not 12 paces off. It was very fortunate for us that the wind was blowing in our favour, i.e., from the animal to us. I did not hesitate a second longer than was necessary, but fired into it at once, as the beast seemed to me to be suspicious and standing stock-still as if listening. There was a crash on the report and away went the bull making a terrific clatter as he smashed his way through the bamboos at a fast gallop. Now came the exciting time. I could not tell where I had hit him but in duty bound we had to follow. There was a certain amount of blood spoor on the ground and judging by the height of the smears left by the wound on the stems and leaves of the surrounding bamboos, as the animal forced its way through the jungle, I would appear to have hit him on the body, too far back in the intestines. After following the animal for about two miles or so we lost the tracks, whilst no blood could be seen on the ground. Bison often have a thick layer of fat under the skin especially about the beginning or end of the cold weather, when they are generally in good condition, and do not in consequence bleed much externally. One would be surprised to see how little blood escapes sometimes from a wound of this kind, which often closes up. If this happens the result is that internal haemorrhage sets in which naturally makes it much worse for the animal especially if he drinks water at any pool or stream as he moves along. All this seems very bloodthirsty and unnecessary, but it is meant more to assist and to initiate the novice in the art and mysteries of big game shooting. However, just at this juncture as Ba Han Tha and I were separated about 30 paces apart casting around most anxiously for the tracks and blood spoor of the bison, which, by the way, had been going up wind all this time, as most wounded animals generally do, to get the scent of those following, there was a loud crash, and before we had realized what had happened, the wounded bull was charging straight down upon us at a great pace. There was no time to do much, but, fortunately, the jungle in that locality was not thick, and one could see ahead and around for 20 or 30 paces clearly enough. The bison in his mad determination to get one or other of us just missed Ba Han Tha by about a foot, he having jumped to one side behind a tree in time. I had nothing to get behind and to make a bolt for it was quite out of the question. As the bison was almost on top of me I threw myself over flat on the ground to one side clutching the heavy rifle with my right hand. The animal took me in his stride crossing over my legs. I could almost have counted the black hair on his wet jet black muzzle, as he shot over me. I remember wondering at the time as I lay, which foot would come down upon me and why the brute did not stop to gore me, for it did not strike me at the time that he had missed me, and that he was travelling so fast that he could not possibly pull up until he had overshot me by a good many yards. I was up and on to my feet again and round like a flash for, after overshooting me by some 25 or 30 paces, he pulled up on to his haunches scoring the wet ground with his hoofs for nearly 8 or

10 yards in the mighty efforts he made to pull up, and wheeling round came back at me again full tilt, with lowered head evidently meaning to finish either myself or Ba Han Tha. I fired my first shot somewhat hurriedly as he wheeled round. This shot as I afterwards discovered gave him a nasty flesh wound in the side of the chest without doing much damage or reducing his pace in the slightest and he was almost on to me, within 3 or 4 paces, in fact, when my second shot got him fairly in the centre of the neck and after ploughing a hole clean through it found a resting place in the animal's stomach. This lucky shot which smashed the vertebrae crumpled him up at my feet like a sack of potatoes pitched out of a cart, for he collapsed on to his head, and after turning a complete somersault, rolled over and remained motionless, with the exception of a tremor here and there, and uttering at the same time a long-drawn-out mournful bellow. It was certainly very exciting whilst it lasted, too exciting in fact, and I must admit I was shaking like a leaf from the excitement when it was all over. The bull when he collapsed fell with one leg over my discarded rifle, which I had flung from me after the second shot, intending to make a bold bid for freedom should I not bring the animal down with my second shot. In the heat of the moment I quite unjustly cursed Ba Han Tha my hunter for not firing at the bison as it passed over and returned at me. I was quite wrong, however, in doing this and made amends afterwards for what I had said, as he explained to me quite correctly that it was quite impossible for him to fire either when the bull was passing over me or even when it was coming back at me for fear of hitting me as I was more or less in the line of fire. Moreover, as he reminded me he had never fired a gun of the description he was carrying before and was unaccustomed to its use. My first shot I found after holding a post-mortem had hit the bull through the ribs on the right side and had found its exit on the opposite side. This bull, had I not got him, would certainly have hunted Ba Han Tha or myself as a terrier dog would have hunted a rat. His horns measured 79 inches from tip to tip outside measurement across the forehead. The girth of each horn was 19 inches. The bull itself measured a little under 20 hands.

I shot a very fine old solitary bull bison near the Pidaung Plain, in the Myitkyina District of Upper Burma which was blind of one eye, the right one and minus his tail. When I was following this animal's tracks on foot at 8 a.m. one morning it looked to me as if he was heading for the railway line with the intention of crossing it and entering the Pidaung Plain, now a game sanctuary. I was following the bull armed with a single-barrelled take down 577 cordite rifle by Messrs. Westley Richards, which took a charge of 100 grains of cordite, and was accompanied by a very good Kachin tracker. We were nearing the railway line carefully picking up the tracks and keeping our eyes and wits about us when I suddenly caught sight of the bull coming back on his tracks having been evidently disturbed by some coolies coming along the railway line. He was a monster. We met at about 15 paces. I happened to be on his blind side and as he passed me I let him have a shot behind the shoulder. I had opened out a fresh tin of ten cartridges that morning with soft nosed bullets. On receiving the shot the bull collapsed into some 'theke' grass, some four or five feet high, a kind of grass which is commonly used by the people for thatching the roofs of their houses. I immediately sent the tracker up an adjacent tree to see what had happened. No sooner did the Kachin begin to make a rustling noise in his ascent of the tree than the bull rose to his feet and came blundering along in my direction to try and get at me without however knowing my exact position as I was still, as I afterwards discovered, on his blind side. I had by now inserted another cartridge into the chamber of the rifle and let drive at him again. He collapsed again on receiving the bullet not five yards away; but, as he was struggling hard to regain his legs once more I finished him off with a third shot, which got him in the neck and severed the vertebrae. Had I been using a small bore rifle, such as some men use upon these animals, I am afraid it would not have fared very well with me. The bullets from the first two shots had made their exit on the opposite side taking a large amount of the contents of the stomach with them which showed that they had mushroomed properly and done their duty. The bull's tail had probably been bitten off short in some encounter with a tiger which had probably damaged his right eye at the same time. The animal's horns measured 86 inches from tip to tip across the forehead taken outside, and were beautifully corrugated. This bull measured a little over 20 hands at the shoulder, noted down after a very careful measurement. For a picture of this bull see Pl. II, 1. The elephants in this picture were used as baggage animals only.

I once used a double hammerless 303 upon a solitary bull bison when these weapons first appeared on the market, somewhere about the eighties or about the beginning of the nineties when they were very highly spoken of by men who had used them in Africa. I was on the top of the Yoma Mountains on the watershed some 4,000 feet above sea level far away from all villages. The summit was all open undulating country covered with short grass and ferns. The jungle and undergrowth came up from below on either side and ended off abruptly like a park at home. I was seated on a rock gazing into space as in a dream, devouring the magnificent view that lay stretched out at my feet to the west towards the sea when I was rudely aroused from my idle reverie by my hunter Tha Yauk's voice informing me that he saw two dark objects lying down on the grass out in the open some 600 yards or so away which he took to be sambar. My glasses soon proved that he was right and a closer inspection revealed the fact that two of the animals were stags with good heads. Leaving my 8-bore in charge of two men and telling them on no account to move from the grassy knoll we were then standing on, Tha Yauk and I strolled off to stalk the animals. The sambar were lying on an open grassy slope devoid of all cover and about 150 yards away from a narrow belt of densely wooded jungle some 30 yards in width which, fortunately, intervened and hid us from view.



1. A solitary Bull Bison (*Bibos gaurus* H. Smith) shot near the Pidaung Plain, measuring 20 hands at the shoulder.

2. A solitary Bull Bison (*B. gaurus* H. Smith) shot at an elevation of 4,000 ft. in the Yoma Mountains.

Telling Tha Yauk to lie down till he heard me fire I went down on all fours and commenced the stalk. One of the stags who was looking in my direction from the slope above some 300 yards off immediately came into view and then lay down. I thought at first I had been seen and hardly knew what to do as I was not prepared to risk a shot at the animal which was not lying in a very favourable position. While lying flat on the grass meditating as to whether I should risk a shot or not I was suddenly startled by hearing the sound of some large animal cropping the grass a short distance ahead of me. Raising my head cautiously above the grass I peered over a slight dip in the ground regardless as to whether the sambar saw me or not and to my utter astonishment in a hollow below me, only a few yards away I saw a solitary bull bison feeding head on towards me. To say that I received the shock of my life was putting it midly and as can be imagined I wriggled back again and joined Tha Yauk three times as quickly as I had moved forward to stalk the sambar. It may be all right sometimes for some men to tackle a solitary bull in the jungle with a 303 when you are behind the protection of a big tree or clump of bamboos, but to do so in the open, with not a tree or a bamboo in sight in the vicinity, is tempting providence. Tha Yauk after reconnoitring the bison's position came back with the information that as the animal was evidently grazing slowly towards a small cluster of rocks which jutted out slightly from the hillside some 50 or 60 yards above him, and about 150 yards from where we were, it would be more advisable to fire at him from the rocks instead of tackling him in the open where he was sure to charge and get one of us, even if I did happen to hit him in a vulnerable spot with the 303. If we lay out at full length flat on the rocks the animal would not be able to see us unless we moved but if he did spot us he could get at us easily from in front or from either side. Tha Yauk and I finally decided after a short palaver to take up our position on the rocks and trust to the 303 with solid nickel coated bullets. I had only 4 of the latter with me and 6 with soft noses. We did at one time think of sending back for the 8-bore and chance the animal remaining in the same position and not getting our wind, but gave up the idea.

Some people may perhaps want to know why I could not have killed the animal with one shot through the head considering it was only a few yards off and feeding head on to me. There are several very cogent reasons why I did not do so, one of these being that on one occasion I tried and failed at ten paces to finish off a wounded bull bison by putting a 303 bullet into the spot where I thought the brain lay.

Then again the brain pan of a bison is, if anything only a little larger than a breakfast cup. How much harder then would it be to place a bullet in the brain of an animal that was moving its head from side to side in the act of feeding? A bullet will sometimes even if driven clean through the head of a bison fail to bring him down. I once met a solitary bull bison standing facing me in some bamboo jungle on the watershed of the 'Yoma hills between Arakan and Thayetmyo'. The distance between us was about 25 paces. I fired at the animal's head using an 8-bore Paradox and hardened conical bullets driven by 10 drachms of powder. The bull on receiving the shot turned round as if unhit and galloped off for over a mile. I came up with him again after a stalk of about three-quarters of an hour but he got up out of some thick stuff, having heard my approach, and dashed away down a steep hillside at the bottom of which, however, he collapsed quite suddenly stone-dead. The bullet, I found after a careful examination, had hit the bull exactly on the centre of the muzzle, between and a little above the nostrils, and after passing clean through the head and neck without touching the brain, was picked out of the cavity of the stomach having pierced the liver and lungs in its course. Internal hæmorrhage had killed him subsequently.

But let me get back to the other bison. A small valley on our right enabled us to make a detour and take up our position on the bunch of rocks already referred to, unperceived by the bull. Two sambar, a doe and a stag, had in the meantime risen and were grazing quite unconcernedly about 100 yards above our position. The old stag I had first seen with the fine head, did not seem to mind our presence in the slightest, although he had watched us crawl up to the rocks and then lie down. He kept his head turned steadfastly in our direction, nevertheless, and occasionally flicked an ear or shook his head. I really believe that these sambar took us for some four-footed animals like themselves and that they had never seen any human beings before. There would have been a very different tale to tell, however, I expect had the wind been blowing from us to them for their instinct would have warned them then that all was not right and they would probably then have galloped off out of sight. The rocks upon which Tha Yauk and I were lying were flush with the slope behind us and although they jutted out a little from the face of the slope and had a drop of less than five feet in front looking towards the bison, there was nothing to prevent the animal charging us from in front, behind, or on either side. Our invisibility was our only protection. We arranged beforehand that if matters should not go well with us we were to make a bee-line for the jungle by the shortest route, a matter of about 100 yards or so. The bison had now taken up a position broadside on to us at a distance of about 40 yards, its left side turned towards us. Making myself as comfortable as possible, I placed my cap under one elbow, and my handkerchief under the other, as the rocks were rather rough, and after taking a deliberate aim fired for the point of the shoulder low down. The bull on receiving the shot spun rapidly round first to one side and then round again to the other side repeatedly with quick jerky movements in his endeavours to locate us, emitting at the same time through his nostrils two or three loud short sharp spurts of air, its whole demeanour and actions indicating the while a curious admixture of fury, fear and defiance. Finally, after swinging round and round backwards and forwards several times as if standing on a pivot in its endeavours to make out its enemies, it stood stock-still with its right side turned broadside on to us affording me another excellent shot, which I immediately availed myself of, letting him have another solid bullet clean through the right shoulder. This bullet took effect in some unaccountable manner on the other side, for the bull presently began to limp off slowly on three legs, the left foreleg which had been shattered at the shoulder, swinging free of the ground. Stepping off the rocks, regardless of dear old Tha Yauk's warning to remain and fire from where I was, and taking advantage of several bunches of grass and tall ferns I crept up unperceived to within about 10 paces of the bison and killed him with one shot which must have passed through his heart for on feeling the bullet he stood perfectly still for a second or two and then after lurching unsteadily forward from side to side in a vain effort to maintain his equilibrium, he collapsed and died after uttering the usual long-drawn-out death bellow followed by a few convulsive quiverings. (For the photograph of this animal see Pl. II, 2.) Had Tha Yauk and I been in the open in full view of this bison when I fired my first shot with the 303 things would not, I am afraid, have gone very well with us, as in all likelihood I would never have been able to stop the animal with my second or even third shot. There are no doubt some really powerful magnum small bore rifles on the market just now, that are capable of doing a lot of damage but I am of opinion nevertheless that no one should begin using them on large dangerous animals until they have first gained a very great deal of experience ,of such game armed with rifles of heavier calibres. The new 303 magnum cartridge, recently introduced, which has a streamlined bullet and whose official designation is 303 mark VII is said to propel a bullet to a distance of 5,500 yards as compared with the extreme range of the present service rifle viz. 3,600 yards, may make some difference in the efficacy of the 303 when used on certain kinds of game by experienced sportsmen.

If my readers will not be bored, I will relate the result of another encounter I had with a solitary bull bison which very nearly ended my career. I was out in the Thayetmyo Yoma hills between Arakan and Burma with a brother police officer, F. C. Annesley by name, who like many other old pals of mine have gone to that undiscovered land from whose bourne no traveller or animal returns. We left camp in different directions, each accompanied by our own hunters. I went westwards into the Arakan Yoma hills accompanied by my hunter Tha Yauk who alas has also gone to Nirvana. A—, not being much of a climber, skirted the valleys below in search of elephants, a large herd of which, with several fine tuskers were reported to be in the vicinity. My hunter and I reached the top of the watershed after some 3½ hours' steady climbing. The jungle on the top came up and ended off abruptly on either side like a park at home. It was all open undulating country with short grass whilst ferns, orchids and wild flowers abounded. Here, whilst admiring the view and soliloquizing on things mundane, I had the luck to witness in a small valley below devoid of all jungle a battle-royal between two fine sambar stags which were surrounded by an admiring retinue of about 8 or 10 does and young stags. It was the clash of their horns which could be heard a long way off as they met in mid air that had first attracted my attention. It seemed cruel, but we have all inherited to some extent in our breasts the savage instincts of our forefathers and I was determined to put an end to the contest by bagging the stag with the best antlers. This I succeeded in doing with a well placed soft nosed bullet from my 303. As it was by this time past sunset we started off downhill again towards camp by a different route to the one we had come by. When half way down, when it was almost dark I had three shots with my 8-bore Paradox at a solitary bull bison that was ascending the ridge down which we were making tracks for camp. The shots were fired in failing light at ranges varying from 40 to 50 yards and the bullets were as I afterwards discovered badly placed in each case. On receiving the second bullet the bull walked slowly behind a large bamboo clump and standing there uttered the low, deep, menacing warning, rumbling note, already referred to by me in a previous portion of this article. As it began to get too dark to enable me to align the sights of my rifle properly we decided to return to camp. Unfortunately in spite of my hunter Tha Yauk's wonderful knowledge of the jungles we took the wrong ridge down to the valley and had in consequence to camp for the night in the jungle under a bamboo clump. Next morning we reached camp at about 7 a.m. A— was very interested to hear about my experiences with the bison and stag sambar and said he would like to accompany me on the following day as he had never seen a bison dead or alive and would like to see one. 'Right oh,' said I, 'come along by all means.' I knew, however, what this meant viz. too many followers, and consequently too much noise, whilst Annesley was a big heavy man not in good training who could not walk through the jungle without making a deuce of a noise. After going a few miles, we were approaching the place where I had left the bison the evening before, when I heard the animal rise stiffly to his feet in a clump of bamboos some 40 yards or so ahead. It may be stated here that a bison rises from the ground with his hind legs first whereas an elephant does so with his front legs. Tha Yauk, my hunter, now whispered to me 'Sir, there are too many of us, ask the gentleman A— who steps so heavily to fall back a bit so that you and I can enter the jungle alone as the bull will most certainly charge us or make off altogether if we all go on together as we are doing now and if he charges some one is sure to be killed.' Tha Yauk was quite right of course and A—, like a wise fellow kindly consented to fall back about 150 yards with his men. I then went on ahead alone armed with the 8-bore Paradox with Tha Yauk some 40 yards to the rear. Nothing could be seen of the bull and although I guessed his whereabouts I could not see any portion of him. 'Anyway,' I said to myself, 'he must be pretty sick after having had three heavy conical 8-bore bullets into him the day before and cannot do much harm.' I reckoned without my host, however, as the old devil had plenty of life left in him still as I found out to my cost. I was standing between two large bamboo clumps which were about 8 or 10 feet apart bending forward peering intently into the bamboo jungle ahead with the 8-bore held in my right hand across my right knee with my left hand resting on my left knee to see if I could see him as the jungle was by no means dense. Just then there was a loud crash and out came the bull at me travelling, for a wounded animal, at a great pace. He had evidently been waiting for just such a moment. To say that I was taken aback was putting it mildly. It took the bull such a short time to cover the distance between us that all I remember having time to do was to cock the hammerless action of my rifle when he was about five paces from me, and take a flying leap to my right behind one of the two clumps of bamboos I had been standing between. The bison swerved to his left at the same time with me, and, after carrying away a number of the bamboos of the clump I had jumped behind, lunged out at me with his horns, and caught me a nasty blow on my left thigh with the rounded portion of his left horn as he passed me, sending me spinning to the ground. It was a close call but I was up like a shot and went off limping and dodging in and out of the bamboo clumps like a wounded rabbit in the direction the bison had come from, fully expecting the bull to come back at me again any minute. Fortunately for me, he did not do so, but headed straight on into the jungles ahead. My thigh was bruised and sore, and took on all the colours of the rainbow that evening from my knee to my groin, but, fortunately no bones had been broken and I was not incapacitated from going at a slow walk. On the contrary, I was fit enough on the following morning to take on the bull's tracks again accompanied this time only by my hunter Tha Yauk. 'Sir', said the dear old fellow to me as we moved off stealthily on the trail of the bison like two leopards following up a deer, 'keep a careful lookout ahead, and on either side, whilst I do the tracking, as I am not as young as you are, whilst I am also a little deaf. Your eyes are good, Sir, and you have also good hearing. It would be a bad business for me if you were killed, as I might be blamed. This is a dangerous animal and his wounds will have made him vicious. He will most certainly charge and get one of us if we do not get him next time we meet him.' About 2½ to 3 hours after this, we had gone perhaps about 5 miles from the spot the bison had charged me the day before, and were proceeding cautiously down a densely wooded slope towards a stream known as the Bathi Chaung, when I happened to hear a very faint rustling sound ahead. The noise could have been made by a pheasant, or a barking deer, moving quietly through the undergrowth, so slight was it. Drawing Tha Yauk's attention to it at once by uttering a faint hiss, I pointed ahead and there sure enough, some 30 paces off amongst the undergrowth the black outline of the bull could be clearly seen standing stock-still head on like a block of black marble, ready to charge, the moment we reached the bottom of the incline. Poor brute! I suppose he thought he could not be seen. To let him have a right and left from the 8-bore Paradox was the work of a moment. A crash followed the two reports as the grand old beast dashed away only to collapse when he had reached the other bank of the Bathi stream some 70 yards away.

# THE HYDERĀBĀD STATE ORNITHOLOGICAL SURVEY

BY

Sàlim Ali.

With Notes by Hugh Whistler.

## Part IV.

(*Continued from page* 919 *of Volume* xxxvi).

## Family: Picidæ.

**Dryobates mahrattensis mahrattensis** (Latham). The Yellow-fronted Pied Woodpecker.

*Picus mahrattensis* Latham, Suppl. Index Orn. (1801), p. xxxi—Mahratta Country. [Restricted to Belgaum, Stuart Baker Fauna B.I., Birds (2nd. ed.), vol. iv, p. 46.]

Specimens collected: 56 ♀, 57 ? 8-10-31, 131 ♂? 14-10-31 Manānūr 2,000 ft.; 393 ♂ 30-11-31 Narsampēt 800 ft.; 628 ? juv., 629 ♂ 2-4-32 Utnoor 1,250 ft. The Sparrow Collection has ♂ ♀ 25-1-11 Jālna.

Elsewhere noted at: Nelipāka, Pāloncha, Āsifābād, Kaulās, Bhāmarvādi.

Iris reddish-brown; bill plumbeous, horny-brown on culmen; mouth greyish-pink; legs, feet and claws horny-grey or slate. In juvenile (No. 628) Iris brown; bill pale horny-grey, dusky on culmen; mouth pale pink; legs and feet lavender grey, claws darker.

[The Survey specimens measure as follows:

| | Bill. | Wing. | Tail. | Tarsus. |
|---|---|---|---|---|
| ♂ ♂ | 24-27 | 98-103 | 55-60 | 15-18 mm. |
| ♀ | 23.5 | 100 | 59 | 18.5 mm. |

and therefore belong clearly to the southern and typical form. The blacker brown and richer red of the lower parts, as compared with north-western specimens, are also typical. The specimens from Jālna in Col. Sparrow's collection also agree.—H.W.]

The Yellow-fronted Pied Woodpecker is generally distributed throughout the State. It is usually met with in pairs frequenting well-wooded country as well as light deciduous forest, mango-groves and the like, flying from tree to tree, often alighting on the stem near the ground and scuttling its way upwards, peering into the crevices of the bark and tapping from time to time to dislodge lurking insects. It was noted as a common constituent of the localised forest associations.

*Breeding*: On 18 March (Kaulās) a nest was located in the hollow vertical branch of a dry tree in open deciduous forest, at a height of about 18 ft. It contained chicks. The female parent brought a dragonfly; it approached the hole in a very cautious and circumspect manner, first alighting on distant branches then hopping across to the stem some way above the entrance-hole and surreptitiously sliding backwards and downwards to the hollow, uttering a concerned '*click, click*' from time to time. I observed identical manoeuvres in another case also.

No. 628 (2 April) was a juvenile with very imperfectly ossified skull and was attended by its male parent (No. 629) who carried a grub in his bill. The testes of the latter—measuring ca. 4×3 mm.—appeared to to be reverting to non-breeding condition. He had an incubation patch on the abdomen which suggests that both sexes share in incubation.

Davidson & Wenden (S.F., vii, 78) found this woodpecker common and breeding in suitable localities in the Deccan. Aitken (N. & E., ii, 306) records a pair at over 4,000 ft. on Singurh near Poona on 26 May.

**Dryobates hardwickii hardwickii** (Jerdon). The Pigmy Woodpecker.

*Picus* (*Dendrocopus*) *hardwickii* Jerdon, Madras Jour. Lit. Sci., vol. xiii (1844-1845), p. 138—South India = Goomsoor.

Specimens collected: 58 ♂, 59 ♀ 8-10-31 Manānūr 2,000 ft.; 155 ♂ 17-10-31, 174 ♀ 19-10-31 Farāhābād 2,800 ft.; 382 ♀ 26-11-32 Pāloncha 300 ft.; 649 ♂ 4-4-32 Utnoor 1,250 ft.; 735 ♂ 22-4-32 Bhāmarvādi 2,500 ft.

Elsewhere noted at: Nelipāka, Kaulās, Itchora.

Iris pale lemon yellow; bill horny grey, dusky on culmen; mouth greyish-pink or greyish-magenta; eyelids and skin round eye magenta; legs and feet dark slate or purplish-brown; claws brown.

[The west- and east-Himalayan forms (*nanus* and *semicoronatus*) appear to me to be specifically distinct to the forms found in the Peninsula, and for the latter therefore *hardwickii* will remain the specific name. The genus *Yungipicus* cannot possibly be maintained (see Ticehurst, J.B.N.H.S., xxxiv, 469)—H. W.]

This little woodpecker inhabits secondary jungle and open deciduous forest, being met with singly or in pairs, usually the latter. On the Amrābād Plateau I commonly found it among the localised forest associations. Its actions and movements are often very reminiscent of a Nuthatch. I have noticed it on several occasions probing into the flowers of *Butea frondosa;* a specimen shot off these, however, had no pollen adhering to its bill or feathers. I also found it feeding regularly on the pulp of 'charoli' drupes (*Buchanania latifolia*).

*Breeding*: On 31 March (Itchora—Utnoor) a juvenile just out of nest was observed being fed by its parent. From the testes of No. 735 (22 April) it was apparent that it had finished breeding.

The gonads of the rest of the specimens gave no indication as regards breeding.

**Brachypternus benghalensis** Linn. The Golden-backed Woodpecker.

*Picus benghalensis* Linn., Syst. Nat., ed. x, vol. i (Jan. 1758), p. 113—Bengal.

Specimens collected: 98 ? 11-10-31 Manānūr 2,000 ft.; 157 ♀ 17-10-31 Farāhābād 2,800 ft.; 211 ? 1-11-31 Borgampād 160 ft.; 268 ♂, 269 ♀ 9-11-31 Nelipāka 160 ft.

Elsewhere noted at Kaulās, Bhāmarvādi.

Iris reddish-brown; bill horny-black; mouth slaty-pink or greyish-pink; skin round eye sage green; legs and feet greyish leaf-green; claws slate.

[This species is individually very variable in the features on which the subspecific distinctions are based and only a certain percentage of extreme specimens can therefore be definitely identified. All five specimens from the eastern side of Hyderābād are intermediate in character and match equally well many specimens both of *puncticollis* and of *benghalensis.* The upper parts are richly coloured as in *benghalensis;* the spotting on the throat is intermediate but more nearly approaches that of *puncticollis.*—H.W.]

The Golden-backed Woodpecker is fairly common everywhere in Hyderābād State, being more abundant in some localities than in others. It frequents gardens and compounds, mango topes, deciduous forest as well as scrub jungle with small trees, usually in pairs. Its food consists to a great extent of large black ants (*Camponotus compressus* ?) which the bird mostly picks off the trunk and branches of trees, sometimes even from the ground. The stomachs of two examined contained these insects exclusively. The tongue of a specimen preserved for morphological examination measured 133 mm.

*Breeding*: The gonads of all the specimens were in an undeveloped condition, but on two occasions (19 and 25 March, Kaulās) a bird was observed emerging from the same hole in a dry tree-stump at about 12 ft., where it was apparently breeding.

**Chrysocolaptes festivus** (Boddaert). The Black-backed Woodpecker.

*Picus festivus* Boddaert, Table Pl. Enlum. (December 1783) for Pl. Enlum. 696—Goa, India.

No specimen obtained, but Col. Sparrow's collection has a ♀ (evidently immature) 19-2-1911 Mirzāpalli, Deccan.

I came across a pair of these woodpeckers on a thickly afforested hillside at Bhāmarvādi (ca 2,500 ft.) on 23 April. The timbre of its call was easily distinguishable from that of the Golden-backed species, though the two are perhaps often confused.

Vidal records it as uncommon in Ratnagiri; Butler (S.F., ix, 385) mentions it from Dhārwār.

**Jynx torquilla torquilla** Linn. The Wryneck.

*Jynx torquilla* Linn., Syst. Nat., ed. x, vol. i (1758), p. 112—Sweden.

Specimens collected: 236 ?, 237 ♀ 3-11-31 Borgampād 160 ft.; 452 ? 11-12-31, 479 ♂ 16-12-31 Āsifābād 1,200 ft.

Elsewhere noted at: Narsampēt, Mūkhēr, Kāmāreddi, Bhāmarvādi.

Iris brown; bill brownish flesh colour; gape yellowish cream; mouth pale pink; legs and feet greyish leaf-green; claws dusky.

The Wryneck is a common winter visitor to the State. The last seen by me was on 21 April (Bhāmarvādi). It is met with singly or in pairs in open scrub jungle or about hedges etc. in the neighbourhood of cultivation. It hops about the ground in search of ants and other insect food remarkably like a finch, and its general behaviour and flight are also very finch-like. In Hyderābād I observed that it kept much more to the ground than to trees, only flying up into them when disturbed, but descending again to feed as soon as danger was past.

The organs of the specimens were in a quiescent state.

## FAMILY: CAPITONIDÆ.

**Thereiceryx zeylonicus** (Gmel.). The Green Barbet.

*Bucco zeylonicus* Gmel., Syst. Nat., vol. i, pt. i (1788), p. 408—Ceylon.

Specimens collected: 27 ♂ 5-11-31 Manānūr 2,000 ft.

Elsewhere noted at: Farāhābād, Borgampād, Nelipāka, Pāloncha, Utnoor.

Iris hazel brown; bill pale orange-red; mouth pale pink; orbital skin orange, more reddish above eye; legs and feet pale lemon yellow; claws dusky.

[An intermediate specimen. It agrees very closely in colour with *Thereiceryx z. caniceps*, but is too small for that race, having a wing 117.5 mm. Five males in my collection measure 121.5-125.5 mm.—H.W.]

This barbet is purely a forest species and common in the forested tracts of the Telingāna, its call of '*krrrr, ku-troo, ku-troo*' etc. being in many localities one of the commonest bird voices in the jungle. I did not meet with it west of a line from Utnoor to Manānūr. Its food consists to a large extent of Peepal (*Ficus religiosa*) and Gulair (*F. glomerata*) figs.

The testes of the specimen were undeveloped.

**Xantholœma hæmacephala indica** (Latham). The Crimson-breasted Barbet.

*Bucco indicus* Latham, Index Orn., vol. i (1790), p. 205—India.

Specimens collected: 80 ♀, 81 ♂ 10-10-31 Manānūr 2,000 ft.; 225 ♀ 2-11-31 Borgampād 160 ft.

Elsewhere noted at: Farāhābād, Hyderābād City and Environs, Singarenni Collieries, Nelipāka, Kaulās, Utnoor, Bhāmarvādi.

Iris brown; eyelids coral red; bill dark horny-brown or black; mouth pale pinkish-grey; legs and feet coral red; claws black; soles yellowish.

The Coppersmith is a common and familiar bird throughout the State affecting gardens and groves as well as forest. When the various species of *Ficus* are in fruit these birds invariably collect on the trees to feed in company with Mynas, Green Pigeons and numerous other frugivorous species.

*Breeding*: The gonads of the specimens were in non-breeding condition. On 19 March one was observed feeding young in a nest-hole in a decayed branch ca 25 feet up in deciduous forest, and another on 22 April was similarly occupied. In the latter case the chicks—two in number—were three-quarter fledged. The nest hole was about 12 ft. from the ground. On 20 April a bird was busy excavating in a dry branch.

Both parents appear to assist in feeding the young.

In Belgaum, Butler took nests from 11 February to 25 March (N. & E. ii, 332).

## FAMILY: CUCULIDÆ.

**Cuculus canorus** or **C. micropterus ?**

I constantly observed some species of cuckoo of a slender build, somewhat smaller than a Shikra and with longish tail, flying about singly high up over the Amrābād Plateau. Unfortunately no specimen could be secured; hence its identity must remain doubtful.

The Sparrow Collection contains a specimen of *Cuculus canorus* labelled: ♀ 22-9-12 Trimulgherry, on which Mr. Whistler comments as follows: 'This specimen belongs to the paler type (with the undertail-coverts lightly barred) which is usually called *telephonus*. In view, however, of my own experience that both *canorus* and *telephonus* types are found breeding in the same area in Kashmir territory and E. V. Kozlova's opinion (Ibis 1932, 588) that *telephonus* cannot be admitted as a valid race, it appears wiser to keep this record under the typical form.

**Hierococcyx varius** Vahl. The Common Hawk-Cuckoo.

*Hierococcyx varius* Vahl., Skriv. Nat. Selsk. Kjöbenhavn, vol. iv (1797), pt. i, p. 61—Tranquebar.

Specimens collected: 142 ♂ (imm.) 16-10-31 Farāhābād 2,800 ft.; 282 ? 16-11-31 Nelipāka 160 ft. The Sparrow Coll. contains the following: ♂ 31-1-12, ♂ 1-2-12, ♂ 26-2-11 Trimulgherry.

Elsewhere noted at Āsifābād, Kandahār, Mūkhēr, Utnoor, Bhāmarvādi.

*In adult*: Iris orange-yellow; eyelids same; bill greenish-brown, black on culmen; gape yellow; legs and feet chrome yellow; claws duskier.

*In immature*: Iris dark grey; eyelids greenish-yellow; bill orange-yellow, greenish at base of both mandibles; gape and mouth bright lemon yellow; legs, feet and claws chrome yellow.

The Hawk-Cuckoo or Brain-fever Bird appears to be fairly generally distributed throughout the Dominions. It haunts gardens, mango topes, scrub jungle and deciduous forest, and is usually met with singly. The flight—a few rapid wing beats followed by a little sailing—and its habit of shooting up into the branches of a tree before alighting are exactly like those of the Shikra (*Astur badius*). Many small birds are sufficiently taken in by its appearance to sound the alarm, and I have constantly noted the flutter it causes among them.

Its monotonous 'Brain-fever' call was noted as the earliest bird note at Bhāmarvādi, being frequently heard between 2 and 3 in the morning, and sometimes throughout the night.

*Breeding*: No. 142 (16 October) was one of two immature birds being tended by a pair of *Turdoides s. malabaricus*, under which species a fuller account of them has been given. The clamour of the young sounded like some of the harsh single notes occasionally uttered by the Rose-ringed Parakeet (*Psittacula krameri*).

**Cacomantis merulinus passerinus** (Vahl). The Indian Plaintive Cuckoo.

*Cuculus passerinus* Vahl, Skriv. Nat. Selsk. Kjöbenhavn, vol. iv, pt. i (1797), p. 57—Tranquebar.

Specimens collected: 90 ♂ 11-10-31 Manānūr 2,000 ft.; 249 ♂ 5-11-31 Borgampād 160 ft. The Sparrow Coll. contains the following: ♂ 30-11-10, ♂ ♀ 16-6-11 Trimulgherry.

Elsewhere noted at Hyderābād City and Environs, Narsampēt, Kandahār.

Iris bright orange-red in No. 90, khaki in 249; bill horny-brown, tinged with orange-red at base of lower mandible in 90, greenish-brown in 249; gape and mouth bright orange-red (brick-colour) in 90, gape yellow, mouth pale yellowish brick-red in 249; legs and feet brownish-yellow; claws dark brown; soles bright orange-yellow; eyelids in 90 bright orange-red.

The Plaintive Cuckoo is a generally distributed and common species throughout the area. It keeps, usually singly, to gardens, groves and open scrub country near cultivation. Its call of several notes *Peee-pi-pee-peee*, *pi-pee-peee* or just *pi-pee*, *pi-pee* is a familiar sound in Hyderābād gardens and is usually uttered from some exposed part of a tree. When calling, the bird's tail remains depressed, the rump is slightly arched and the wings often droop at the sides.

The stomach of one contained remains of a grasshopper and many red bugs (Coccinelid?). It sometimes descends to the ground and hops a few steps after insects, and I have also observed one catching red bugs in mid-air after the manner of a flycatcher.

*Breeding*: The organs of the specimens were in an undeveloped condition. On 23 October (Saifābād) a juvenile was observed being fed and fussed over by a pair of Ashy Wren-Warblers (*Prinia socialis*) (see note). The imposter was fully fledged and able to fly about. The 'cheeps' it uttered when clamouring to be fed were low and feeble such as one would expect from a much smaller bird. While in the act of being fed it uttered a long excited cheeping noise. In Hyderābād City and immediate environs this Cuckoo usually lays in the nests of *Prinia socialis*, while a few miles outside, the Tailor Bird (*Orthotomus sutorius*) is the common fosterer. In both these cases, as shown by the remarkable series collected by Mr. R. K. Burnett, the colouration of its eggs has evolved in such a way as to bring about a close resemblance to those of the fosterers in the two different areas.

Fairbank (S.F., iv, 255) records the Plaintive Cuckoo from Ahmednagar and the Goa Frontier. According to Vidal (Butler, S.F., ix, 388) it is common during the rains in many parts of the south, especially in the forest tracts west of Belgaum as far west as Vengurla, less common northwards. He noticed it at Satāra and considers it rare at Ratnāgiri.

**Penthoceryx sonneratii sonneratii** Latham. The Indian Bay-banded Cuckoo.

*Penthoceryx sonneratii* Latham, Index Orn., vol. i (1790), p. 215—India.

Specimen collected: 572 ♂ 18-3-32 Kaulās 1,400 ft.

Elsewhere not noted.

Iris brown; bill horny-black, olive-grey at base of lower mandible; legs and feet greyish-green; claws horny brown.

The above was a solitary bird among overgrown fort ruins, hunting insects in the same manner as the Plaintive Cuckoo. It was silent.

The testes measured ca 4×2 mm. and appeared to be developing.

From neighbouring areas, Fairbank (S.F., iv, 255) records it from Khandāla on the Ghats, and Butler (S.F., ix, 388) from Belgaum.

**Clamator jacobinus** (Boddaert). The Pied Crested Cuckoo.

*Cuculus jacobinus* Boddaert, Tabl. Pl. Enlum (1783), p. 53 for Pl. Enl. 872—Coromandel Coast.

Specimens collected: 343 ♀, 344 ♂ 20-11-31 Pāloncha 300 ft. The Sparrow Coll. contains the following: ♂ (ad.) 23-10-10, ♂ (imm.) 5-12-10, ♀ (imm.) 9-12-10, ♀ (ad.) 13-6-11, ♀ (ad.) 15-6-11.

Elsewhere noted at: Hyderābād City and Environs, Manānūr, Borgampād, Khūldābād and Vizāpūr (Aurangābad Dist. 18-31 October 1924).

Last seen 20 November (Pāloncha).

In No. 343: Iris brown; bill horny-black, lemon-yellow at chin; mouth pale yellowish pink; legs and feet slaty-grey; claws black. In 344: gape and basal two-thirds of lower mandible lemon-yellow; mouth: inside both mandibles bright yellow; palate and gullet livid pink.

[The two races depend entirely on measurements. A small series of adults (2 ♂♂ wing 144 mm., 3 ♀♀ wing 145-154 mm.) collected in Hyderābād suggests that they are closer to the small race *taprobanus* than to the larger typical race, and the dates tend to corroborate this. For the present therefore it is advisable to leave the name binomial.—H.W.]

The Pied Crested Cuckoo is probably a rainy season migrant into the Hyderābād State as it is in neighbouring areas. It frequents gardens, groves and the neighbourhood of cultivaion and is usually met with either singly or in pairs. I found it silent on the whole and the birds had probably finished breeding by then. It is fond of hunting among low bushes and scrub close to the ground.

The specimens were a pair, the only ones seen in the locality, and also the last to be met with by the Survey. Their gonads were undeveloped and they were in worn brownish immature plumage although their skulls furnished no indication as regards juvenescence.

At Kihim in the Kolāba Dist. of North Konkan, where also it is a rainy season immigrant, I observed a pair in copula on 16 August. About this time the birds were busy foisting their eggs on Bombay Babblers (*Turdoides s. somervillei*) and I recovered a fully formed egg from the oviduct of a female shot on 29 August.

**Eudynamis scolopaceus scolopaceus** (Linn.). The Koel.

*Cuculus scolopaceus* Linn., Syst. Nat. ed. x (1758), vol. i, p. 111—Bengal.

Specimen collected: 165 ♀ 18-10-31 Farāhābād 2,800 ft.

Elsewhere noted at: Hyderābād City, Āchampet, Manānūr, Borgampād, Mūkhēr, Utnoor, Aurangābād, Bhāmarvādi.

Iris brownish-red; bill pale sea-green, dusky on culmen; legs and feet slaty-blue; claws dusky.

The Koel is generally distributed in the State, but I did not find it really abundant anywhere. Before 19 January it was noted as quite silent but thereafter its crescendo *Koo-oo, koo-oo* etc. was increasingly heard, till about the end of April it was heard on all sides, being also one of the earliest bird voices in the morning. Koels were regularly observed feeding on ripe Peepal and Banyan figs in mixed avian company.

The ovaries of the specimen were in non-breeding condition. Davidson & Wenden (S.F., vii, 79) considered the Koel common in the Deccan in the rains and breeding then. According to Butler (S.F., ix, 389) it is a permanent resident in some of the Deccan districts though locally common throughout the region, especially in Belgaum and Ratnagiri etc. where he found it very abundant. The same writer took eggs in Belgaum from 13 April to 15 May (N. & E., ii, 395-6).

In the neighbourhood of Bombay and about Kihim in the Kolāba district (N. Konkan) the principal laying season seems to be June and July, synchronising with the breeding of the House-Crow (*Corvus splendens*) in whose nests most of the eggs are deposited.

**Rhopodytes viridirostris** (Jerdon). The Small Green-billed Malkoha.

*Zanclostomus viridirostris* Jerdon, Madr. Jour. Lit. Sci., vol. xi (1840), p. 223—Coonoor.

Specimens collected: 97 ♂ 11-10-31 Manānūr 2,000 ft.; 359 ♂ 23-11-31 Pāloncha 300 ft.

Elsewhere noted at Borgampād.

Iris dark brown; loose crinkled orbital skin greenish-grey in 97, sky-blue in 359; bill sea-green, paler in 97, richer in 359; palate sea-green, gullet slaty-black; legs and feet olive-slate; claws dusky.

This Cuckoo was met with singly, in scrub and secondary jungle, and usually kept to low bushes and trees.

*Breeding*: The testes of the specimen were undeveloped. Davidson & Wenden (S.F., vii, 79) who considered it tolerably common in the jungles about Nulwar, took a nest with two eggs there in July.

Other breeding records from neighbourhing areas are as follows: A clutch of two eggs on 10 March near Wandiwash in North Arcot (Cardew); another clutch of two eggs in the granite hills N.-E. of Nulwar station in the middle of July (Wenden) (N. & E., ii, 399).

Butler (S.F., ix, 389) considered this a resident species and not uncommon in the Deccan and Southern Mahratta country. He describes it occurring in the jungles about Belgaum, Ratnagiri and Nulwar.

**Taccocua leschenaultii leschenaultii** Lesson. The Southern Sirkeer Cuckoo.

*Taccocua leschenaultii* Lesson, Traite d'Orn. (May 9, 1830), p. 144—L'Inde.

Specimens collected: 592 ♀ 22-3-32, 596 ♂ 23-3-32 Kaulās 1,350 ft. The Sparrow Coll. contains ♀ 22-12-? Trimulgherry.

Elsewhere noted at: Mālegaon (Nander Dist., Mrs. Tasker !), Kandahār, Kannad, Bhāmarvādi, Utnoor.

Iris brown; bill magenta-crimson, yellow at tips of both mandibles and brown on commissure; mouth slaty- or brownish-black; legs and feet horny plumbeous; claws duskier.

Excepting just once at Utnoor, I met this bird only in the drier portions of the State—the Mahrattwāda. It inhabits open, broken, lightly-wooded or scrub-covered hillsides, and was on the whole shy. Frequently, when followed up, it alights on the ground and escapes by running over the loose stones and dodging round the bushes at great speed, with lowered head and horizontally held tail.

Davidson & Wenden (S.F., vii, 79) recorded this species as common in the Nulwar jungles and also in the bare hills at Satāra. They secured a specimen at Lanaoli in the Ghats. Vidal obtained a few specimens and eggs in Ratnāgiri, and Jerdon procured specimens at Jālna (Butler, S.F., ix, 389).

*Breeding*: No. 592 (22 March) had the ovarian follicles developed to ca. 3 mm. in diameter, and the testes of No. 596 (23 March) measured 5×3 mm. The birds at this period had paired off and it was apparent that they were preparing to breed. The behaviour of a pair on 23 April (Bhāmarvādi) also suggested that they were breeding.

**Centropus sinensis parroti** Stresemann. The Southern Crow-pheasant.

*Centropus sinensis parroti* Stresemann, Nov. Zool., vol. xx (1913), p. 323—Ceylon.

Specimen collected: 642 ♂ 3-4-32 Utnoor 1,250 ft. The Sparrow Coll. contains: ♀ 10-1-11 Limbgāon, Deccan ♀ 20-2-11 Masaipēt, Deccan.

Elsewhere noted at: Manānūr, Borgampād, Āsifābād, Kandahār, Aurangābād, Bhāmarvādi, Hyderābād City & Environs.

Iris crimson; bill, legs, feet and claws black.

A common species throughout the State, affecting scrub jungle, light deciduous forest and the neighbourhood of cultivation, usually singly or in pairs. Besides the familiar *Ook-ook-ook* call, it has a large variety of harsh croaks and chuckles.

The stomach of the specimen contained one large locust and other unidentifiable insect remains. Its testes were small and gave no indication as regards the breeding season.

## FAMILY: PSITTACIDÆ.

**Psittacula eupatria eupatria** (L.). The Large Indian Paroquet.

*Psittacus eupatria* Linn., Syst. Nat., ed. x (1766), p. 140—Gingee.

Specimens collected: 129 ♂ 14-10-31 Manānūr 2,000 ft.; 176 ♂ 19-10-31 Farāhābād 2,800 ft.

Elsewhere noted at: Borgampād, Pākhāl Lake, Āsifābād, Kaulās, Utnoor.

Iris lemon-yellow; eyelids orange-yellow; bill scarlet, orange-red at tips and darker on culmen; legs and feet dirty yellow; claws slate.

[The above two males have wings 214 and 215 mm. respectively and the beak is less massive than in *nipalensis*.—H.W.]

The Large Indian Paroquet was commonest on the Amrābād Plateau, a locality which for some obscure reason has become famous popularly for its wonderful variety of parrots! Actually, I found no others besides this and the next two species, none of which happen to be confined to this neighbourhood.

This species keeps in small parties of four to ten birds, and I found it much less destructive to jowari and other crops than the other parakeets. On the Amrābād Plateau it usually kept to the forest and was seldom seen in cultivated country except when flying across from one patch of jungle to another. Its cry is deeper and more 'sedate' than that of the Rose-ringed species.

The testes of the specimens were in non-breeding condition.

**Psittacula krameri manillensis** (Bechst.). The Rose-ringed Paroquet.

*Palæornis manillensis* Bechst., Stubenvögel (1794), p. 612—Ceylon.

Specimens collected: 25 ♂ 5-10-31 Manānūr 2,000 ft.

Elsewhere noted at: Singarenni Collieries, Borgampād, Pākhāl Lake, Āsifābād, Kandahār, Mūkhēr, Utnoor, Kaulās, Nirmal, Ellora, Aurangābād, Hyderābād City & Environs.

Iris greyish-blue; eyelids bright orange; bill scarlet, brownish on commissure and brownish-black on tips; mouth pale flesh pink; legs, feet and claws grey.

This is the commonest paroquet in the Dominions, and one of the most destructive individual bird species to ripening crops. I frequently observed flocks of hundreds in jowari fields. It also does much damage to fruit gardens and has practically no compensating virtues. It is a constant attendant on the blossoms of *Butea frondosa* and *Erythrina indica*, but even here its value as an agent in their cross-pollination is doubtful. Mhowa flowers when in season, also form a substantial part of its dietary. The birds may frequently be seen at wayside railway stations clinging to bags of grain awaiting shipment, biting into them and helping themselves to the contents.

*Breeding*: The organs of the specimen were in an undeveloped condition. On 26 April, numbers were observed occupying holes in the scarp of rock at the back of Kailāsa Cave at Ellora, but whether they were actually breeding at the time it is difficult to say. On 14 April the same was noted of several birds in holes in buildings in Aurangābād City.

Davidson & Wenden (S.F., vii, 78) who also found it common in the Deccan, say that it breeds in December, January and February. Butler (N. & E., iii, 86) took clutches of 3 and 4 eggs at Belgaum on December 28 and 31 and on February 3 and 23.

**Psittacula cyanocephala cyanocephala** (L.). The Blossom-headed Paroquet.

*Psittacus cyanocephalus* Linnaeus, Syst. Nat., ed. xii (176 ), p. 141, No. 10—India orientale=Gingee.

Specimens collected: 164 ♀ 18-10-31 Farāhābād 2,800 ft.; 467 ♂ 14-12-31 Āsifābād 1,200 ft.; 626 ♂ 1-4-32 Utnoor 1,250 ft.

Elsewhere noted at: Manānūr, Borgampād, Pāloncha, Pākhāl Lake, Kannad, Bhāmarvādi.

♂ Iris outer ring cream colour, inner khaki; bill, upper mandible orange with paler tip, lower mandible brownish-black; legs and feet greenish-grey; claws plumbeous. ♀ iris lemon yellow; bill yellow, dusky at sides and tip of lower mandible; legs and feet pale grey; claws dusky; mouth pale fleshy grey.

A generally distributed and fairly common species, though more confined to wooded country. On the Amrābād Plateau it is a scourge to the cultivator and does great damage to ripening jowari crops, being assisted in its ravages by the Rose-ringed Paroquet. I have frequently seen flocks of between two and four hundred birds in this locality.

The flight of these paroquets is very swift, and flocks on the wing turn and twist their way through the stems of trees in the forest with astonishing agility and orderliness, uttering a shrill interrogatory *tooi*? or *tooi-tooi*? This peculiar call and the yellow tail-tip which is conspicuous in flight make their identity unmistakable.

Besides grain, I found their food to consist largely of Ficus figs and the small black drupes of *Zizyphus oenoplia*. Mhowa and *Butea* flowers are also eaten and a specimen shot off the latter had a quantity of pollen adhering to its throat feathers.

This bird appears to be a resident in some parts of its range while in others it is only a seasonal visitor; its status in the Hyderābād State is uncertain. It is said by Davidson & Wenden (S.F., vii, 78) to be an abundant resident in the Satāra District, but in the Sholapoor District to be apparently more of a rains visitor. Fairbank (S.F., iv, 255) also states that it is common along the Sahyādris but visits the Deccan plains in flocks only at some seasons. According to Butler (S.F., ix, 384) most retire to the Ghats to breed. Aitken (N. & E., iii, 88) records its arriving in flocks about the middle of June in Berar, after an absence of several months.

*Breeding*: The gonads of the specimens were in non-breeding condition, but on 31 March (Utnoor) a pair were observed in courtship, immediately after which the female entered a hole in a dead tree at about 12 feet (deciduous forest) whence she could be dislodged only after much knocking. On 12 April also a pair was noted in courtship on the wall of the ruined fort at Nirmal, and the birds appeared to be breeding in one of the numerous holes there.

According to Davidson & Wenden (S.F., vii, 78) it breeds in the plains of the Satāra District in December and on the Ghats in March.

## FAMILY: CORACIIDÆ.

**Coracias benghalensis indica** Linn. The Indian Roller.

*Coracias indica* Linn., Syst. Nat., ed. xii, vol. i (1766), p. 159—Ceylon.

Specimens collected: 367 ♂, 368 ♂ 24-11-31 Pāloncha 300 ft. The Sparrow Coll. contains ♂ 1-11-10, ♂ 25-11-10, ♂ 16-1-13 Trimulgherry.

Elsewhere noted at: Hyderābād City Environs, Manānūr, Kāzipēt, Borgampād, Nelipāka, Āsifābād, Kandahār, Utnoor, Aurangābād.

Iris pale brown; eyelids dull orange; bill brownish-black; mouth sulphur yellow and pink; legs and feet dirty brownish-yellow; claws black.

[The Survey specimens as well as those in Col. Sparrow's collection and an unsexed Hyderābād specimen of Gould's in the British Museum are indistinguishable in colour from the Ceylon race and also agree in measurements with the Ceylon bird.—H. W.]

The Roller is a common and familiar bird (resident?) of cultivated and open country throughout the State. At Utnoor (April) it was found to be abundant in the leafless deciduous forest, the attraction no doubt being the suitable nesting sites afforded by holes in the dry trees. The birds as a rule are met with singly or in pairs, perched on posts, stakes or hedges near fields, whence they descend to the ground now and again to pick up an insect, returning with the morsel to the same perch or flying lazily across to another in the vicinity. Like the Drongo, they appear to be wholly beneficial to agriculture, and their destruction for the sake of their showy plumes (which I unfortunately often observed) should be severely penalised.

*Breeding*: The testes of the specimens were in a quiescent state. By the beginning of March courtship displays had become common. In these, the male usually rises perpendicularly to some height in the air to the accompaniment of hoarse cries, and describes a series of wave-crests, his glorious plumage flashing in the sun. The axis of the body, held vertical till the crest is reached is thereupon suddenly reversed so that the bill which was formerly pointing skywards now points to the ground. In this manner the bird shoots down with closed wings about the same distance he had mounted, and after a few repetitions of this stunt returns to his perch on the top of some tree or other exposed situation. Much the same sort of display is indulged in by the Black-bellied Finch-Lark also.

From about this time on, pairs were observed appropriating suitable holes in dry trees as nesting sites and chasing off kites, crows and other birds that transgressed into their territories, with loud raucous screams and much bluster. Between 1 and 10 April, it was commonly found to be breeding in holes in trees in the deciduous forest about Utnoor.

Aitken (N. & E., iii, 54) found it very common in Berār and also nesting there in May, and in the face of the evidence we have it is difficult to understand the statement of Davidson & Wenden (S.F., vii, 77) that it does not breed in the 'Deccan' (by which presumably they meant the Bhima Valley).

## FAMILY: MEROPIDÆ.

**Merops orientalis orientalis** Latham. The Common Indian Bee-eater.

*Merops orientalis* Latham, Ind. Orn. Suppl. (1801), pl. xxxiii—Mahratta Country.

Specimens collected: 634 ♂ 2-4-32 Utnoor 1,250 ft.; 701 ♂ 16-4-32 Kannad 2,000 ft.

Elsewhere noted at: Hyderābād City & Environs, Manānūr, Singarenni Collieries, Borgampād, Narsampēt, Āsifābād, Kandahār, Kaulās, Aurangābād, Nirmal and Bhāmarvādi. Also at Mālegaon (Nander Dist.) and Khūlābād (Aurangābād Dist.) by Mrs. Tasker.

Iris scarlet or brownish-crimson; bill brownish-black; mouth pink; legs and feet yellowish-brown; claws horny brown.

The status of this bird in Hyderābād seems to be partly resident and partly winter visitor. Although some numbers remain the whole year round and breed, a marked influx from outside was noted from the end of September and in the first half of October. From this time on, upto the end of February or thereabouts, the Bee-eater was very common all over the country. Thereafter there was again a noticeable diminution in their numbers and what remained behind had mostly paired off.

Large numbers assemble to roost in the evenings on selected trees, and much noise and bustle prevails before the birds finally retire for the night. Every now and again the whole concourse rises in the air and after circling round in a confused rabble to the accompaniment of much 'trilling' the birds gradually settle down once more. These manoeuvres are repeated several times before quiet is restored. They are late risers and may frequently be seen huddled together in groups on the branches of a tree with their heads tucked away under their wings and fast asleep till after the sun is well up. I frequently observed them capturing and eating dragonflies.

Davidson & Wenden (S.F., vii, 77) found this species common and breeding in the Deccan. According to Aitken (N. & E., iii, 61) they disappear in the hot weather from Poona, which I have also noticed to be the case with the large majority of Bee-eaters in and around Bombay.

*Breeding*: The testes of both the specimens (2 and 16 April) appeared to be developing. They measured ca. 5×3 mm. On 21 April a pair had cheeping young in the side of a pit in the D.S.P.'s garden near the Aurangābād Jail. Other birds, from their behaviour, also appeared to be breeding about this time.

**Merops superciliosus javanicus** Horsf. The Blue-tailed Bee-eater.

*Merops javanicus* Horsf., Trans. Linn. Soc. vol. xiii, pt. i (May 1821), p. 171—Java.

No specimen obtained.

I am unable to say whether this bird is just a passage migrant over Hyderābād State or whether some birds actually winter in this area. In the course of the Survey I only came across a small party of 3 or 4 birds at the foot of the Amrābād Ghāt on 4 October. The only other record I have for the area is a flock of about 12 birds seen at Saifābād (Hyderābād City) between 5 and 11 October, 1925.

Davidson got a young specimen near Pundharpūr in October and states (S.F., vii, 77) that they are not common in the Deccan (Bhima Valley) and appear only in the cold season. Fairbank (S.F., iv, 254) seems to have met with it only once at Ahmednagar.

The flight of the Blue-tailed Bee-eater seems much swifter and the swoops more graceful than those of the smaller species, while its call notes are lower in key and easily distinguishable from those of the Common Bee-eater, but very similar to those of the next species.

**Melittophagus erythrocephalus erythrocephalus** (Gmel.). The Chestnut-headed Bee-eater.

*Merops erythrocephalus* Gmelin, Syst. Nat., vol. i, pt. i (1788), p. 463—India orientale.

Specimens collected: 277 ♀ 9-11-31, 337 ♀ 17-11-31 Nelipāka 160 ft.

Elsewhere noted at: Pāloncha Hill, Pākhāl Lake.

Iris brownish-orange or scarlet; bill black; mouth pink; legs and feet brownish-slate; claws black.

Small flocks of the Chestnut-headed Bee-eater, usually of 4-8 birds, were seen in forest in the above localities, launching graceful sallies after winged insects and circling back to their perches on the bare upper branches of forest trees. I found their call notes indistinguishable from those of the Blue-tailed species.

The ovaries of the specimens showed no departure from the normal non-breeding condition.

Fairbank (S.F., iv, 254) met with this Bee-eater on the sides and bases of the Goa and Sāvantvādi Hills, and Butler (S.F., ix, 382) noticed it on the Amboli Ghāt west of Belgaum.

## FAMILY: ALCEDINIDÆ.

**Ceryle rudis leucomelanura** Reichenbach. The Indian Pied Kingfisher.

*Ceryle leucomelanura* Reichenbach, Handb. Alced. (1851), p. 21—Ceylon.

Specimen collected: 528 ♂ 9-3-32 Mūkhēr 1,350 ft.

Elsewhere noted at: Hyderābād City and Environs, Kāzipet, Dornākal, Borgampād, Narsampēt, Āsifābād, Kandahār.

Iris brown; bill, legs, feet and claws horny-black; mouth pale yellowish-pink.

A common resident species, almost invariably present about tanks and streams, usually in pairs. The hovering, which is such a spectacular habit of this Kingfisher, is invariably done against the wind, the bird taking full advantage of the resistance. Occasionally the bird has to wheel right round to do this.

*Breeding*: The testes of the specimen were undeveloped, but on 22 March a nest was dug up in the bank of a stream at Kaulās, about 12 inches above water level, with a tunnel about 3 feet long. It contained 4 newly-hatched chicks and one cracked egg. Inspite of the excavation, the parents continued to feed the young. A fresh fish, one inch long, was found in the nest.

Davidson & Wenden (S.F., vii, 77) found this Kingfisher common in the Deccan (Bhima Valley) and apparently breeding at all seasons except the very hot months. Aitken (N. & E., iii, 10) took a clutch of 6 eggs at Akola (Berār) at the end of January or the beginning of February.

**Alcedo atthis bengalensis** Gmelin. The Common Indian Kingfisher.

*Alcedo bengalensis* Gmelin, Syst. Nat., vol. i, pt. i (1788), p. 450—Bengal.

Specimens collected: 518 ♀ 7-3-32 Mūkhēr 1,350 ft.; 662 ♀ 6-4-32 Utnoor 1,250 ft.

Elsewhere noted at: Nelipāka, Dornākal, Pākhāl Lake, Āsifābād, Kandahār, Nirmal, Kannad.

Iris brown; bill, upper mandible brown, gape and lower mandible bright orange; mouth orange-brick; legs and feet like lower mandible but brighter; claws dusky.

This little Kingfisher is a resident species and commonly found in the neighbourhood of streams, pools, flooded borrow-pits and even wells. It is usually solitary except in the breeding season when pairs is the rule. I definitely failed to meet with it at Manānūr and Farāhābād.

*Breeding*: No. 518 (7 March) had the ovaries in a quiescent state, while in 662 (6 April) the follicles measured ca. 1 mm. in diameter, and were apparently maturing. On 12 April (Nīrmal) a brood of 4 fully-fledged chicks was observed at a roadside pool being tended by one of the parents who brought them small fish. The bill, legs and feet of the young were horny-brown, the latter tinged with red.

Davidson & Wenden (S.F., vii, 77) found this species fairly common and breeding in the Bhīma Valley. They took a nest at Satāra in June. Bruce took clutches of 5 and 6 eggs respectively on 15 March at Rahuri (Ahmednagar) and Butler a clutch of 4 hard-set eggs on 22 August and another of 7 eggs on 3 September (N. & E., iii, 2-3).

**Ramphalcyon capensis** (Linn.) ssp.?. The Brown-headed Stork-billed Kingfisher.

*Alcedo capensis* Linn., Syst. Nat., ed. xii, vol. i (1766), p. 180—Cape of Good Hope *in errore*=Java.

No specimens obtained.

Noted at Pākhāl Lake, Āsifābād and Utnoor.

This large kingfisher is entirely a forest species, keeping to heavily shaded and overgrown forest streams either singly or in widely separated pairs. Its chattering call or 'laugh'—*ke-ke-ke-ke-ke-ke* is somewhat like that of the White-breasted species but louder and more raucous. I have an unconfirmed note that one was heard at Saifābād on 19 and 20 January.

Fairbank (S.F., iv, 254) found it once near Mahābleshwar and Mr. Laird (S.F., ix, 382) obtained it in the forests west of Belgaum.

**Halcyon smyrnensis** (Linn.) subspecies? The White-breasted Kingfisher.

*Alcedo smyrnensis* Linn., Syst. Nat., ed. x, vol. i (1758), p. 116—Africa and Asia.

No specimens obtained.

A common, familiar and generally distributed species met with both near and away from water in deciduous forest, scrub country and cultivation. Its food seems to consist more of insects than of fishes and frogs. On one occasion I saw it carry off a day-old chick of the Red-wattled Lapwing.

Davidson & Wenden (S.F., vii, 77) describe it as very abundant in the Deccan (Bhima Valley) and breeding there in March and April. Fairbank (S.F., iv, 254) and Butler (S.F., ix, 382) also found it common and generally distributed and a resident everywhere.

In the neighbourhood of Bombay (N. Konkan) I have taken eggs in the first half of May.

## FAMILY: BUCEROTIDÆ.

**Hydrocissa malabaricus** (Gmelin). The Malabar Pied Hornbill.

*Buceros malabaricus* Gmelin, Syst. Nat., vol, i (1788), p. 359—Malabar.

No specimens obtained.

I came across this Hornbill only at Borgampād in the Godāvari Forest Belt on the extreme eastern boundary of the State. A flock of 6 birds was met three days in succession in a patch of riverain jungle on the banks of the Kinārsāni River. They were extremely wary and kept to the tops of the loftiest trees, feeding on a species of *Ficus* figs. Their loud harsh call was also once heard subsequently at Nelipāka (10 November).

**Tockus birostris** (Scopoli). The Common Grey Hornbill. Telugu: *Supanāti.*

*Buceros birostris* Scopoli, Del. Flor. et. Faun. Insubr., vol. ii (1786), p. 87 —Coromandel.

Specimen collected: 551 ♂ 15-3-32 Deglūr 1,300 ft.

Elsewhere noted at: Manānūr, Farāhābād, Borgampād, Pāloncha, Mūkher, Utnoor, Aurangābād, Kannad, Bhāmarvādi.

Iris bright brownish-orange; bill slaty-black on basal portion including casque, creamy-white on culmen, tips and most of lower mandible; mouth: palate pale yellowish-flesh, gullet dark slate; legs and feet slaty-black; claws black.

A commonly distributed species usually met with in pairs or small parties in light deciduous forest or open country about villages and cultivation, wherever there is a sprinkling of *Ficus* trees in fruit. Among a mixed gathering of birds feeding on ripe Banyan figs near Manānūr village, as many as thirty of these Hornbills were counted. It has a shrill alarm whistle '*wheee*' by which the assembly is apprised of the approach of danger. It soon breaks up into small parties which fly off in different directions in follow-my-leader fashion. The flight, typical of the hornbills, consists of a few laboured wing beats followed by intervals of sailing.

The stomach of the specimen contained Banyan figs (*Ficus bengalensis*) exclusively.

*Breeding*: The testes of the specimen were enlarged to 16×10 mm. and the bird was evidently preparing to breed. I presume that it was not actually breeding at that date from the fact that it was one of a party moving about in a mango grove near Deglūr town.

A single male was seen in a grove of large mango trees at Kannad (16 April) from whose behaviour it appeared that he might have his mate on a nest in the neighbourhood.

Davidson & Wenden (S.F., vii, 78) record it as moderately numerous in suitable places in the Deccan i.e. principally the Bhima Valley.

## FAMILY: UPUPIDÆ.

**Upupa epops ceylonensis** Reichenbach. The Ceylon Hoopoe.

*Upupa ceylonensis* Reichenbach, Handb. spec. Orn., Scans. (1853), p. 320,—Ceylon.

**Upupa epops orientalis** Stuart Baker. The Indian Hoopoe.

*Upupa epops orientalis* Stuart Baker, Bull. B.O.C., xlii (29 November 1921), p. 29—India.

Specimens collected: 124 ♀ 13-10-31 Manānūr 2,000 ft.; 350 ♂, 351 ♂ 21-11-31 Pāloncha 300 ft.; 576 ? (imm.) 19-3-32 Kaulās 1,350 ft.; 702 ♀ (imm.) 16-4-32 Kannad 2,000 ft.

Elsewhere noted at: Hyderābād City & Environs, Kandahār, Mūkhēr, Utnoor, Nīrmal.

Iris brown; bill horny-brown or horny-black, paler (flesh colour) at gape and base of lower mandible; mouth pale flesh; legs and feet greyish- or slaty-brown.

[Nos. 124, 576 and 702 belong to the small dark resident form *ceylonensis* without the white at the end of the crest. Nos. 350 and 351 are of the north Indian form *orientalis*, evidently a winter visitor to Hyderābād. This probably is the *epops* of some records.—H.W.]

The Hoopoe affects open country in the neighbourhood of cultivation and villages as well as scrub jungle and light deciduous forest. It is usually met with in pairs which are often much separated when feeding on the ground. It probes amongst fallen leaves and in the earth with the bill partly open like a pair of forceps. The crest is erected and opened out fanwise upon alighting after every short flight. It runs about on the ground on its short legs with a quail-like but somewhat waddling gait, at times quite fast.

*Breeding*: About the beginning of March, I noticed that the males had begun calling their distinctive *Hoo-po* or *Hoo-po-po* etc. on every side. While uttering this, the head jerks forward as if the bird was barking, and the crest is erected and depressed from time to time. No. 576 (19 March) was a juvenile with imperfectly ossified skull, while 702 (16 April) was slightly older having the unossified portion confined only to the centre of the skull.

According to Burgess (N. & E., ii, 335) the Hoopoe (presumably *U. e. ceylonensis*) breeds in the Deccan in the middle of April and in May. Butler (N .& E., ii, 336) took a nest with young on 31 March at Belgaum.

## FAMILY: TROGONIDÆ.

**Harpactes fasciatus** (Pennant) subspecies? The (Malabar?) Trogon.

*Trogon fasciatus* Pennant, Ind. Zool. (1769), pl. iv—Ceylon.

No specimen obtained.

On 12 October (1931) in mixed bamboo jungle on the hillside leading up to Mahēswara Plateau (Amrābād) I caught a fleeting glimpse of a bird that almost certainly was this Trogon. This was the only occasion when I came across the species in Hyderābād State. It was unfortunately not possible to secure the specimen, but it doubtless belonged to the form *malabaricus* of Gould.

Regarding the distribution of this bird in the Southern Mahratta Country Butler (S.F., ix, 381) states that it is resident, occurring sparingly in most of the well-wooded tracts along the Sahyadris and in the forest tract west of Belgaum; that it is not uncommon in Kanara and that Fairbank obtained it in the woods of Sāvantvādi and at the base of the Goa Hills.

Bingham (N. & E., ii, 341) took a nest with eggs about the middle of May on the Rām Ghat between Belgaum and Vingorla.

## FAMILY: MICROPIDÆ.

**Micropus melba** (Linn.) ssp? The Alpine Swift.

*Hirundo melba* Linn., Syst. Nat., ed. x, vol. i (Jan. 1758), p. 192—Gibraltar.

No specimen obtained.

Several of these magnificent birds were constantly observed flying about the escarpment and hills at Outram Ghāt (Bhāmarvādi) 2,500 ft., overlooking Chālisgaon and the Khāndesh Plains (18-24 April).

Davidson & Wenden (S.F., vii, 77) described it as a permanent resident in Satāra, and Davidson thought that it bred about the cliffs and on old buildings in the fort there. As far as I know this has never been confirmed, Butler (S.F., ix, 379) records it only as a cold weather visitor to Deccan and the Southern Mahratta Country being common all along the Ghats where it roosts, going by day to feed over the plains.

McMaster (N. & E., iii, 21) is said to have observed several swifts, apparently this species, at Gawilgarh and Chiklada (Berar) at ca. 3,700 ft. in April and May which appeared to be breeding on the cliffs. This also lacks confirmation.

**Micropus affinis affinis** (Gray). The Common Indian Swift.

*Cypselus affinis* Gray, Illustr. Ind. Zool., vol. i (March 1830), pl. 35, fig. 2—Bengal as known to the E. I. Co.

Specimen collected: 517 ♂ 7-3-32 Mūkhēr 1,350 ft.

Elsewhere noted at: Hyderābād City & Environs, Manānūr, Kandahār. Kāmāreddi Railway Station, Kannad, Ellorā Caves, Khūldābād (Aurangābād Dist.).

Iris brown; bill horny-black; mouth pink; legs and feet pinky brown; claws horny-black.

The Common Swift is a familiar bird in Hyderābād City and in most other towns in the Dominions. It is invariably to be met wherever old forts, mosques, bridges and buildings with porticos are present to furnish suitable nesting sites. Large disorderly gatherings may frequently be seen in the evenings wheeling round high up in the air uttering their shrill joyous 'screams' and quite obviously sporting themselves.

*Breeding*: On 10 October a pair commenced building under the ceiling of the Dak Bungalow verandah at Manānūr, but deserted after 2 or 3 days. On 10 February I observed many nests being built under eaves etc. of the Osmānia General Hospital in Hyderābād City. The testes of the specimen (7 March) measured ca. 7×4 mm. and suggested breeding, although curiously enough as in the case of *Passer domesticus* recorded above, the skull clearly indicated by two soft patches in the centre that the bird was not yet fully adult.

Davidson & Wenden (S.F., vii, 77) found it common everywhere in the Deccan (Bhima Valley) and about Ahmednagar; also Fairbank (S.F., iv, 254) recorded it as abundant. On the other hand Jerdon (B. of I., i, 178) writes: 'I on one occasion traversed the whole tableland of Southern India from the Taipoor Pass near Jaulnah to Salem and only saw it twice and then in small numbers.'

**Cypsiurus batasiensis palmarum** (Gray). The Palm Swift.

*Cypselus palmarum* Gray in Hardwicke's Illustr. Ind. Zool., vol. i (1832), pl. 35, figs. 1a and 1b—Cawnpore.

Specimens collected: 247 ♂ 5-11-31 Borgampād 160 ft.; 681 ? (juv.), 682 ♂ 9-4-32 Utnoor 1,250 ft.

Elsewhere noted at: Hyderābād City & Environs, Malkāpūr, Nekonda, Narsampēt, Kaulās, Aurangābād.

Iris dark brown; bill black; legs and feet dark blackish-brown.

The distribution of this little swift in the State is inseparably linked with the occurrence of *Tad* palms (*Borassus flabellifer*). It is found where the palms are found and is absent where they are absent; thus at Manānūr and Farāhābād the absence of both was conspicuous. The precise factor (or factors) in this biotic relationship needs to be determined, but the rigid folds and furrows of the palm leaf provide admirable roosting and nesting sites for the birds. Along the road from Nekonda Railway Station to Narsampēt, the *Tad* palm increases in abundance after Amīnābād until in the vicinity of Narsampēt it may be counted by the hundred thousand. With the palms a corresponding increase in the numbers of palm swifts is immediately noticeable.

*Breeding*: The testes of No. 247 (5 November) were in non-breeding condition. By about March-April the breeding season appeared to be in progress. No. 681 (9 April) was juvenile with a very soft skull, while No. 682 had the testes enlarged to 6×4 mm. and the bird was in general (post-nuptial?) moult.

According to Davidson & Wenden (S.F., vii, 77) the Palm Swift is very rare in the drier portions of the Deccan. It is tolerably numerous in the palm groves near Nulwar. Davidson saw 3 amongst some small palms about 5 miles from Akulkote. Fairbank (S.F., iv, 254) found them common in the vicinity of Ahmednagar and Butler (S.F., ix, 380) in Poona. Aitken (N. & E., iii, 26) notes that in Berar palm trees are scarce, but that wherever there is one this bird will be found. He saw it once round a grove of mangoes, miles from any palm.

**Hemiprocne coronata** (Tickell). The Indian Crested Swift.

*Hirundo coronata* Tickell, J.A.S.B., vol. ii (November 1833), p. 580—Borabhum.

Specimens collected: 433 ♂ 7-12-31 Pākhāl Lake 800 ft.; 637 ♂, 638 ♀ 3-4-32 Utnoor 1,250 ft.

Elsewhere noted at: Sirkonda (en route Itchora-Utnoor), Narsampēt.

Iris brown; bill black; mouth pinkish-grey; legs and feet purplish-brown; claws brown.

Besides the above localities, this species was not met with by the Survey. It was commoner at Utnoor than elsewhere, though by no means abundant. The Crested Swift keeps to open deciduous forest. Its flight is very similar to that of the Palm Swift from which, however, it is immediately distinguishable by its larger size and the longer and more deeply forked tail. It utters a harsh *chuck-chuck* or *tichuck-tichuck* from time to time, like *Artamus*, and perches freely like a swallow on the bare higher branches of forest trees.

*Breeding*: The testes of No. 433 (7 December) were undeveloped but both 637 and 638 (3 April) were certainly breeding. The male had the testes enlarged to 5×3 mm. and it had an incubation patch on the abdomen. Some of the ovarian follicles of the female measured 2.5 mm. in diameter.

On 6 April a pair was observed building on the bare twig of a leafless Salai tree (*Boswellia serrata*) at about 40 feet in open deciduous forest bordering a nullah at Arti-Margoo (near Utnoor). The tiny cup looked like a knot in the branch from below. Both birds were working at the structure. The strands of saliva used in the agglutination process were clearly visible gleaming in the sunlight.

Both Fairbanks (S.F., iv, 254) and Butler (S. F., ix, 380) observed the Crested Swift at Khandāla and along the Ghāts. Thompson (N. & E., iii, 37) found a nest with one egg in the Ahiri forests of Chānda (Central Provinces) on 7 May.

## FAMILY: CAPRIMULGIDÆ.

**Caprimulgus indicus indicus** Latham. The Indian Jungle Nightjar.

*Caprimulgus indicus* Latham, Index Orn., vol. ii (1790), p. 588—India.

Specimens collected: 728 ♂ 21-4-32, 746 ♀ 25-4-32 Kannad 2,500 ft. The Sparrow Coll. contains ♀ 1-11-10 Trimulgherry.

Iris dark brown; eyelids dull yellow; bill brownish-black, paler at gape; mouth greyish-pink; legs and feet fleshy- or pinkish-brown; claws black.

A common species chiefly frequenting deciduous forest; flitting about at dusk among the trunks of trees, deftly turning and twisting on the wing as it hawks beetles and other insects. The call is usually uttered from the branch of a tree on which the bird crouches lengthwise. The notes I have likened to water dripping on water (but much louder) at the rate of about 2 drips a second, connected as it were by the echo of the dripping: *chuck-ko, chuck-ko, chuck-ko* and so on.

*Breeding*: The birds appeared to be breeding in April. Specimen No. 728 (21 April) had the testes enlarged to 7×5 mm. while some of the ovarian follicles of the female measured about 1.5 mm. in diameter. Col. Sparrow's shikari collected the following eggs for him (presumably of this species) at Eswantaraopet, about 25 miles N.-W. of Trimulgherry in thin jungle: C/2 19-4-14, C/1 27-4-14, C/2 6-5-14, C/1 24-5-14.

**Caprimulgus monticolus monticolus** Franklin. Franklin's Nightjar.

*Caprimulgus monticolus* Franklin, P.Z.S. 1830-1831 (Oct. 25, 1831), p. 116—Between Calcutta and Benares and in the Vindhyan Hills between the latter place and Gurra Mundela.

Specimens collected: 297 ♀ 13-11-31, 324 ♀ 16-11-31 Nelipāka 160 ft.; 631 ♀ 2-4-32, 665 ♂ 7-4-32 Utnoor 1,250 ft. Col. Sparrow's collection contains ♂ 2-1-11 Ditchpalli, ♀ 16-12-10 Wadiarum.

Iris dark brown; eyelids dull yellow; bill brownish-black, paler at gape; mouth greyish-pink; legs and feet fleshy-brown; claws black. The gape of No. 297 measured 30 mm. across.

This Nightjar inhabits scrub and deciduous jungle. At Nelipāka it was commonly observed hawking insects over the grassy mudbanks bordering the Godāvari River, while at Utnoor dry beds of forest streams with pools here and there invariably attracted these birds. It is largely crepuscular in its habits and is usually heard either between sundown and dark or sometimes a little later, and again at early dawn. The loud penetrating call of a single note, *sweesh* is uttered chiefly on the wing.

*Breeding*: The organs of Nos. 297 and 324 shot in November showed no departure from the normal quiescent condition, but the April birds were breeding. No. 631 (2 April) had the ovarian follicles measuring ca. 1.5 mm. in diameter. It was shot off one hard-set egg lying on a bare burnt patch of ground in deciduous forest. When the body was pressed a quantity of clear viscid fluid like the white of an egg exuded from the vent. The bird was very fat about the rump. There was no depression or lining to mark the nest and no shelter of any kind. The bird skulked off a couple of yards on our approach. The egg was of a shade of salmon in ground colour with blotches and mottling of reddish-brown bearing a remarkable resemblance to the pieces of red marble-like gravel with which the ground here was strewn. It measured 29 × 22 mm.

The testes of No. 665 (7 April) were enlarged to 11 × 5 mm.

Col. Sparrow's collector obtained the following eggs for him (unconfirmed by skin of parent !): C/2 (fresh) 23-7-12 Trimulgherry, C/2 30-7-12, C/2 15-3-13 Eswantarāopet. Col. Sparrow himself found the following in the Central Provinces: C/2 (fresh) 3-5-12 Muthpalli, C/2 (hatching) 20-5-12 Indravati River. From the above dates it appears that the breeding season is a prolonged one.

**Caprimulgus asiaticus** Latham. The Common Indian Nightjar.

*Caprimulgus asiaticus* Latham, Index Orn., vol. ii (1790), p. 588—India, restricted to Bombay (J.B.N.H.S., xxviii, p. 323).

Specimens collected: 100 ♀, 101 ♀, 102 ♂ 12-10-31 Manānūr 2,000 ft.; 523 ♂ 8-3-32 Mūkhēr 1,350 ft.; 582 ♂, 583 ♂ 21-3-32 Kaulās 1,350 ft. Col. Sparrow's coll. contains ♀ 12-12-12 Trimulgherry.

Elsewhere noted at: Hyderābād City & Environs, Borgampād, Kandahār.

Iris brown; eyelids pale yellow; bill horny-brown, paler and pinkish at gape and base of lower mandible; legs and feet brownish-pink; claws dusky.

The commonest Nightjar in the Dominions, being found everywhere about cultivation and in open scrub and boulder country. Its familiar '*chuck-chuck-chuck-chuck-r-r-r*' notes are amongst the commonest bird voices at dusk. These are usually uttered from a perch on a stake, stone or similar situation. The birds are very fond of squatting on roads after dusk and are adept at dodging clear of an oncoming car when it is almost upon them. One of the specimens had a hard-shelled black beetle in its bill.

The first 3 specimens were undergoing a complete moult and their organs were in the normal non-breeding condition. In the birds procured in March a slight development of the gonads was noticeable, but they did not appear to be breeding.

Col. Sparrow's collector obtained 11 clutches of one or two eggs each in thin jungle at Eswantarāopet between 19 April and 7 July.

## FAMILY: TYTONIDÆ.

**Tyto alba** (Scopoli) ssp.? The Barn Owl.

*Strix alba* Scopoli, Annus I, Hist. Nat. (1769), p. 21—Friuli in N. Italy.

No specimens obtained.

Noted in the ruins of the fort and about an old temple near Kaulās village between 18 and 23 March (1932). Also at Talamadri village ca. 15 miles from Utnoor, on 14 October (1925). The bird is probably much commoner than these records suggest.

## FAMILY: ASIONIDÆ.

**Asio flammeus (flammeus?)** Pontoppidan. The Short-eared Owl.

*Strix flammea* Pontoppidan, Danske Atlas, vol. i (1763), p. 617, pl. xxv—Denmark.

Not met with by the Survey.

Col. Sparrow shot a ♂ at Pārtūr on 31-1-11.

**Strix ocellata** (Lesson). The Mottled Wood-Owl.

*Syrnium ocellatum* Lesson, Rev. Zool. (Oct.-Nov. 1839), p. 289—Pondicherry.

Specimens collected: 414 ♂, 415 ♀ 3-12-31 Narsampēt 800 ft.; 643 ♀ (imm.) 4-4-32 Utnoor 1,250 ft.

Elsewhere noted: Kaulās.

Iris orange-brown; eyelids dull coral red; bill blackish plumbeous, paler at tip; mouth pale yellowish-pink; feet dirty yellowish-brown; soles yellow. In immature (No. 643) feet greenish-grey.

The Mottled Wood-Owl is a dweller of forest, where old Banyan trees are a favourite daytime resort. It is usually met with in pairs but after the breeding season family parties of parents with one or two young were seen. At Kaulās it was partial to the ancient Tamarind groves between the village and the ruined fort. Its call, most commonly heard at dusk and at dawn, is a deep eerie quavering *Chu-hooaa.*

Besides this it has a mellow monosyllabic hoot which is more commonly uttered.

*Breeding*: The pair shot on 3 December appeared ready to breed. The testes of the male were enlarged to ca. 14×8 mm. while the largest follicles in the ovaries of the female measured 4 mm. in diameter. Specimen No. 643 was juvenile with soft skull and its rectrices and contour feathers were growing. From the above it is evident that in Hyderābād this owl breeds between December and February or thereabouts. Col. Sparrow's Coll. contains the following eggs: C/2 31-12-13 Navipet, C/1 7-3-14, C/1 1-4-14 Eswantarāopet.

**Ketupa zeylonensis** Gmelin. ssp.? The Fish-Owl.

*Strix zeylonensis* Gmelin, Syst. Nat., vol. i, pt. i (1788), p. 287—Ceylon.

Not met with by the Survey. Col. Sparrow has a record of a pair at Mulloorpet on 28-1-14 and two fledged young at Eswantarāopet on 14-3-13. He also took a fresh egg at the latter place on 28-1-14.

**Bubo bubo bengalensis** (Franklin). The Indian Great Horned Owl.

*Otus bengalensis* Franklin, P.Z.S. 1830-1831 (Oct. 25, 1831), p. 115—Between Calcutta and Benares and in the Vindhyan Hills between the latter place and Gurra Mundela.

Specimens collected: 184 ♂ 29-10-31 Borgampād 160 ft.; 538 ♀ 12-3-32 Deglūr 1,300 ft.; 584 ♀ 21-3-32 Kaulās 1,350 ft.

Elsewhere noted at: Nelipāka, Kannad, Bhāmarvādi.

Iris bright orange-yellow; bill horny black; mouth pink; toes dirty greyish-white; claws horny-black.

This owl frequents well-wooded and boulder hillock country and is partial to mango and tamarind groves. At Borgampād and Nelipāka its favourite resort was among the thick bushes of *Vitex negundo* bordering the steep, deeply outscoured banks of the Godāvari River. They emerged soon after sunset with their deep resounding calls of *Bu-bo* (2nd syllable much prolonged) which while not really loud have the quality of carrying long distances. A small colony of these birds inhabited the rocks of the Pātalganga Gorge at Deglūr. They were shy and flew about in broad sunlight with little apparent discomfort.

The stomachs of the specimens all contained field rats and mice, besides in one case a large earthworm. I also had occasion to examine the pellets disgorged by the birds which were freely strewn about the rocks and found them in every case to consist chiefly of the fur, skulls and other skeletal remains of field rats and mice, while in many cases the pellets were composed exclusively of these. The Horned Owls are a constant natural check on these vermin and therefore obviously of great economic value to agriculture.

*Breeding*: No satisfactory evidence as regards breeding was obtained by the Survey beyond the fact that specimen No. 584 (21 March) had some of the ovarian follicles measuring 1 mm. in diameter. The gonads of the other two specimens were in an undeveloped condition.

Col. Sparrow took a clutch of 4 eggs at Eswantaraöpet on 5-11-14, and found large young at Masaipet on 5 January.

**Otus bakkamœna** Pennant. subsp.? The Collared Scops Owl.

*Otus bakkamoena* Pennant, Ind. Zool., vol. i (1769), p. 3—pl. iii—Ceylon.

Specimens collected: 138 ♀, 140 ♂ 16-10-31 Farāhābād 2,800 ft.

Not noted elsewhere.

Iris brownish-orange; feet dusky lemon-yellow or dusky flesh-colour; claws same but duskier at tips; cere greenish lemon-yellow; upper mandible horny-brown, lower mandible pale flesh colour; commissure brownish.

[These two Scops Owls belong without any doubt to the group of the Collared Scops Owls *Otus bakkamoena* Pennant and the wing formula (2=6/7 in no. 138 and 2=7/8 in no. 140) agrees with this attribution. This group was very thoroughly revised by Ticehurst in 1923 (Ibis 1923, p. 239). The two birds, whilst obviously belonging to the same form are not alike. The female no. 138, wing 146 mm., is a warm fulvous brown in colouration, whereas the male no. 140, wing 144 mm., is of a grey phase. I have carefully compared them at the British Museum. They are certainly not referable to the dark typical race (Ceylon), with which they agree in size, as they are far paler. On the other hand they are definitely too small to refer to *O. b. marathae*. The probability is that they represent an intermediate E. ghats race—for what is Farāhābād expect a slice of the E. ghats contained in Hyderābād State? This is I suspect the form which Jerdon described under his *Scops griseus* Madras Jour. Lit. Sci., xiii, pt. 2, p. 119. I do not think however it would be wise to attempt to set up a new and intermediate race of this highly variable group on two specimens only, more especially when those two specimens vary *inter se*. I should therefore record these specimens binomially until such time as a proper series is available from this or other neighbouring areas of the E. ghats. Unfortunately no Scops Owls were obtained by the Vernay Survey.—H.W.]

Met with in pairs, not uncommonly, in mixed Bamboo forest at Farāhābād.

The gonads of the specimens were in an undeveloped condition.

Col. Sparrow's collector obtained 2 clutches for him (not supported by specimen of parent!) of 4 and 3 eggs respectively on 21 February and 2 April (the latter hard-set) at Eswantaraöpet.

**Athene brama brama** (Temm.). The Spotted Owlet.

*Strix brama* Temm., Planch. Color d'Ois. (1823), livr. 12, pl. 68—Pondicherry.

Specimens collected: 89 ♀ 11-10-31 Manānūr 2,000 ft.; 331 ♂, 332 ♀ Nelipāka 160 ft.

Elsewhere noted at: Singarenni Collieries, Narsampēt, Kandahār, Kaulās, Utnoor, Nīrmal, Aurangābād, Hyderābād City & Environs.

Iris bright lemon-yellow; bill yellowish grey-green; legs and feet dirty lemon-yellow; claws horny-black.

The Spotted Owlet is the commonest representative of the family in the Hyderābād State. It is found in the neighbourhood of villages and cultivation wherever ancient and gnarled tamarind, Banyan or mango trees are present to furnish harbourage. In some localities, as at Manānūr, almost every large tamarind or Banyan tree holds a pair or two, and one has but to tap on the trunk to bring forth an inquiring little face to the entrance of a hollow or to dislodge a pair sitting huddled together on some secluded branch. Though largely crepuscular in its habits it seems little inconvenienced by sunlight and when disturbed flies from one tree to another without any apparent discomfort. I once even observed an individual chasing a Striped Squirrel in bright sunlight. They sally forth from their retreats at dusk and may then be commonly seen perched about on stakes or clods—even on the bare ground—or sailing close to the surface in search of grasshoppers, earthworms, mice, lizards, etc. The flexibility of their necks as with most owls is remarkable. The face can be screwed right round without altering the stanch of the body in the least, so that in fading light it is often difficult to tell if the bird is looking at or away from one!

*Breeding*: The organs of the specimens were in non-breeding condition. On 12 April a nest was found in the crevice of a ruined fort wall at Nīrmal (at about 4 feet) containing one nearly full-fledged young with pirmaries sprouting and as yet unable to fly properly. The nest was a pad of coir fibres, quite clean and without any bones or excreta. On 15 April (Aurangābād) another nest was noted in a hole in an ancient wall at about 15 feet with three chicks in the same stage of growth.

Col. Sparrow has taken eggs in all stages of incubation and chicks (2 to 4 as a rule) at Trimulgherry, Nekonda and Rampoor between 11 March and 10 April.

**Glaucidum radiatum radiatum** (Tickell.). The Jungle Owlet.

*Strix radiata* Tickell, J.A.S.B., vol. ii (Nov. 1833), p. 572—Borabhum and Dholbhum.

Specimens collected: 181 ♂ 20-10-31 Farāhābād 2,800 ft.; 635 ? 3-4-32 Utnoor 1,250 ft.

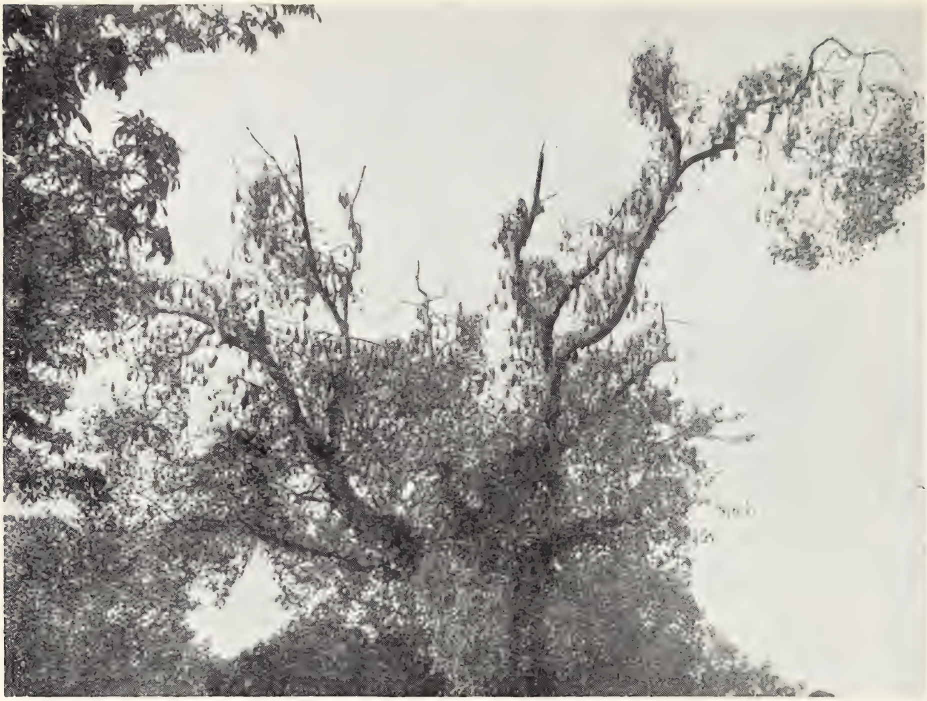
Elsewhere noted at: Pāloncha.

Iris bright lemon-yellow; bill plumbeous- to greenish-yellow; feet dirty lemon-yellow; claws same, blackish at tips.

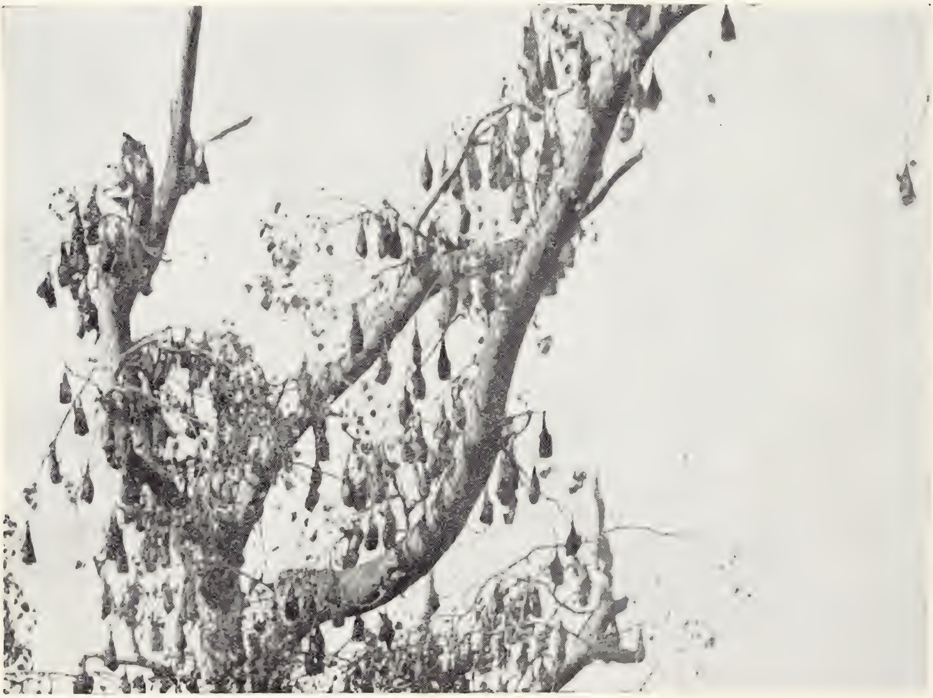
Only met with in forest, either singly or in pairs.

Gonads of the specimens in an undeveloped condition.

(*To be continued*).



Colony of Flying-Foxes (*Pteropus giganteus* Brünn) at Malad, Salsette Island.



A 'close up' of part of the above colony.

*Photos by Author.*

# NOTES ON THE FLYING-FOX (*PTEROPUS GIGANTEUS*, BRÜNN.).

BY

CHARLES McCANN, F.L.S.

(*With one plate*)

The Flying-Fox needs no introduction. It is the largest of the bats. Its weird shape, half rat and half 'bird' or Pterodactyle, finds its place in folklore and legend. The Evil Spirit is generally represented as one of these creatures. In a recent film Dracula was represented as a large bat, undoubtedly, a Flying-Fox, which was considered a vampire, sucking the life blood of its victims. However, this is slur on the true character of this nocturnal animal —it is a pure 'vegetarian'. We must leave the fantastic to the screen and legend and come down to hard facts. Nevertheless, it is noteworthy to observe that legend is frequently based on a natural history point which through ages has been distorted beyond recognition, as we shall presently see.

It is difficult to write anything without reviving and analysing the facts or fallacies recorded by previous writers. Some observation, no doubt, will stand their ground while others must be relegated to the shelves of fiction. Animals and plants are plastic living organisms which cannot be made to conform with man-made rules and regulations—there is as much 'individualism' among them as is to be found in Man. This, is what makes it extremely difficult to observe them and attribute definite reasons for their behaviour. Then again, this is made doubly difficult by the attitude adopted by the observer and his 'individualism' in explaining their actions.

The Flying-Fox, like most other bats is undoubtedly gregarious, at least, this is very much so at the time of roosting. Blanford states, 'Pteropi fly singly, never in flocks'. There is no doubt that they fly singly and not in close formation as do many gregarious birds, but I am of the opinion that certain parties meet and have particular beats when feeding. Flying-Foxes, as is well known, will always return to the same roost for years, and it takes much to drive them away once they have established themselves in a particular locality. EHA (E. A. Aitkin) (*J.B.N.H.S.*, vol. i, p. 144, 1886) observed several trees at Belapur, near Panvel, covered with Pteropi as far back as 1886 and I have no doubt that these colonies still persist in the same neighbourhood, and perhaps on the same trees, if the trees have not died or been removed.

Bombay city is regularly invaded every evening at dusk by large numbers of these animals. Most of them appear to come in from the north. Others come over the harbour from the mainland to the east. To the best of my knowledge, there are two roosts in the island of Bombay, one in the Victoria Gardens at Byculla and another in the grounds of the School of Art. Further north, on the island of Salsette, there are two large colonies, one at Malad[1] and the other at Thanna. At the above mentioned places they are to be found the whole year round, there is no tendency to migrate. These colonies I have known to exist in the same locality for well over 20 years. I have already mentioned the colony at Belapur, near Panvel. Mr. Salim A. Ali tells me that there is one at Kihim. To go further afield, I know of two other colonies, one at Kalyan and the other at Karli, near Lonavala. Mr. Humayun Ali informs me that there is one at Belapur, in the Ahmednagar district. It would be interesting to have a record of all the known colonies. This information would possibly help in studying the distribution and movements of these animals.

It is rather curious that these bats establish their colonies in the vicinity of villages, if not in their very midst. In all my experience, I do not ever remember coming across colonies in the jungles. They appear to be animals truly commensal with man. Generally, the tree which forms the roost is very thinly clothed with or devoid of leaves. This may possibly be due to one of two reasons, or both, the young shoots are broken off by the bats in their movements, or to the effect of the urine falling on the tender tissues of the plant.

To follow the activities of a colony would perhaps be the best way of describing their habits. Towards evening the whole colony is astir, much screeching and cantankerousness is evinced by every member as it gives itself a general 'clean up' before setting out. By nature, Flying-Foxes appear to be quarrelsome, and there is generally much ado about nothing. As the light begins to fade these nocturnal spirits move off by ones and two and in small parties till finally there is not a bat left at the roost. They do not all go in the same direction, but a few follow in the 'wake' of each other. Their first objective is the feeding grounds, these will depend on the fruit or flowers available at the time. *En route* they will have a drink at any tank or stream they may happen to fly over. I shall refer to this habit in more detail later on.

Once at its destination, the Flying Fox concentrates on feeding —now and again quarrelling with neighbours or intruders. It alights in a most clumsy manner on or near its objective. Once there, it moves about by means of its 'hooks' and feet. After feeding for a couple of hours or more, the bats hang about on the tree as they do at the roost. This appears to be an interval of rest. During the mating season this interval is occupied by sexual overtures. As they hang about there is frequently heard a 'clapping' noise, which is made by beating their semi-closed wings together. This clapping appears to me as though it were an invitation to the opposite sex, but I could not definitely establish whether it was made by the female or the male, or by both, though I am inclined to believe the female is responsible for it. I have frequently observed an individual alight near a 'clapping' companion when copulation took place in the 'upside down' posture in which flying foxes hang. I have noticed copulation from October to December. About the middle of January I secured a fairly well advanced embryo. Judging from this, the period of gestation would be a short one. Tickell gives the time of birth as end of March to April, but I am inclined to give it a month earlier, for this part of the country (Bombay). However, this may vary with the locality and needs further investigation. To return to the activities of the flock. After a period of rest the animals feed again for a brief while and before dawn move off in the direction of their roost in the same manner as they left it.

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[1] Since writing these notes, I visited this colony and found that the original roost, a *peepal* tree, has suffered much and in consequence died down considerably. The bats have now taken to the neighbouring trees rather than leave the locality.

The scene at the roost is one of confusion and commotion, and continuous fighting for position. Probably these bats return to the identical spot each morning. With the arrival of each new-comer, which circles round the roost a couple of times or more before coming to rest, the colony is thrown into confusion. This pandemonium does not cease till about 10 a.m., but at no time of the day is a colony really quiet. Too close approach to a neighbour is sufficient for a new quarrel. At the roost they hang upside down in true 'bat fashion' with the snout turned skywards and the whole snout enveloped in the wings. During the hottest part of the day several, if not the whole colony, will be found fanning themselves with one wing or the other. Much time is also spent in scratching, as the animals are usually infested with crab-like ticks, which seem to cause the bats much annoyance. In this way the hours of daylight are past. Looking at the confusion that exists among the members of such a colony one really wonders how much rest these animals get.

Let me now refer to some of the debated points in the life of these interesting creatures. It is hard enough for the naturalist to wrest a few points from the life of diurnal animals, but when it comes to the nocturnal! Well! with unaided diurnal eyes, I must say, I am blind.

*Drinking.*—Jerdon remarks, 'If water is at hand—a tank, a river, or the sea—they fly cautiously down and touch the water, but I could not ascertain if they took a sip or merely dipped part of their bodies in.' Many have no doubt observed this habit of Flying-Foxes as they pass over sheets of water. I have frequently observed these bats skimming over water, pause in their flight to sip the water in the same way as swallows. I have noticed that the head is lowered and the mouth is dipped into the water—I have no doubt that they *do* drink water—in fact, most bats do, if not all. I have frequently watched the Fruit Bat (*Cynopterus sphinx*) go down a well and do exactly the same thing. Dr. J. Shortt [*P.Z.S.* (1863), p. 438] in a letter to the Zoological Society of London attributed this habit of the Flying-Fox to catching fish. This is not likely, as I shall have occasion to show presently. The letter is of interest and as it is in an old number of that

*Journal,* I take the liberty of reproducing it in full. It is as follows:—

"Sir,—

At about 6 p.m. on the 30th of April last, when at Conjeeveram, my attention was attracted to a tank next the Dispensary, which, owing to a light shower of rain that had just fallen, literally seemed alive with small fish gambolling and jumping about in the water. There was nothing new in this; but my attention was drawn to a number of large birds with a somewhat heavy flight, hovering over the water and seizing with their feet the fish, with which they then made off to some tamarind-trees on the bund of the tank, to devour them at their leisure, I suppose.

On a close examination, I discovered that what I had imagined mere birds were none other than flying-foxes, the *Pteropus edulis*. After watching them fishing for some time, I had to leave, owing to the darkness of the evening. I returned to the tank the next evening half an hour earlier, and again witnessed the same occurrence.

I then got my assistant, Mr. Watson, to bring his gun and shoot some, so that I might satisfy myself as to the identity of these animals. Mr. Watson shot some two or three whilst in the act of seizing their fishy prey, and on examination I found them to be actually Flying-Foxes. During a second visit, on the 5th and 6th of June, I observe the same thing occur again.

I am not aware of the fishing-propensities of this animal ever having been noticed, for I find no account of them in any work on natural history that I have had opportunities of consulting on the subject. This habit of the Flying-Fox appearing new to me, I send you this communication, as there may be others who have witnessed the same thing; and if made known, this would, I am sure, prove of interest to the naturalist.

Chingleput, June 12th, 1863."

It is rather a pity that Dr. Shortt after taking the trouble to secure the Flying-Foxes did not take the trouble to examine the stomach contents of the specimens. If he had, he would have soon been convinced that these animals do not catch fish at all, nor eat them. Blanford doubted Shortt's statement and quite rightly. However, with regard to these bats drinking salt water, I have very grave doubts. I have seen them taking a sip in the sea, but this I think is done in error.

*Food.*—Reverting to Shortt's letter, we find the statement that the bats were seizing fish 'with their feet'. Firstly, as I have said, Flying-Foxes do not eat fish; secondly, the feet are so constructed that they are only used as 'hangers' and not for conveying anything. Food, when conveyed, is carried in the mouth. I have frequently watched Flying-Foxes feeding on the fruit of *Bassia latifolia,* and when disturbed, they carried away the fruit in the mouth. Blanford (*F.B.I.* Mammalia, p. 258) quoting from Tickell writes, 'The bats hang, head downwards as usual, by one foot and hold the fruit with the other, not by grasping, but by sticking the claws in like a fork.' I have not observed this behaviour. My observations on these bats eating fruit are somewhat different. They hang in the usual manner by the legs. When chewing a large fruit, they either chew it without detaching it from its stalk, or hold it in the folded extremities ('wrists') of both the wings, or in the folds of one wing, where it is probably held in place by the phalanges. Be this as it may, I have not seen these bats use the feet as described by Tickell. I have seen insectivorous bats with large tail membranes use this interfemoral membrane as a sac and move the prey about with the feet while they suspended themselves with the 'hooks' on the wings.

No doubt many people have noticed the state of the ground below a tree where a party of Flying-Foxes has fed the night previous. The ground is littered with wholly or partially chewn remains of fruit—presumably the excreta of the bats—perhaps few people have ever seen the latter. From the looks of things, the bats must have gorged themselves. Legend has it that the flying-fox has no anus and that it must consequently pass the excreta from the mouth. The following extract from a note in the *Journal* by Fitzpatrick entitled *Folklore of Birds and Beasts in India* (*J.B.N.H.S.*, xxviii, 562) will not be out of place. It is told that the Almighty permitted Moses to try his hand at Creation.

"The second effort was not so successful, he still kept the ground plan of the rat and now put wings on the beast thus making the bat. As the Almighty imbued it with life, Moses in great excitement, called out 'My Lord and God, don't let it fly yet for I have forgotten the anus.' 'Too late,' said God, thus the bat flies without an anus." After repeated observations I am convinced that the Flying-Fox lives on juices and on fruit which liquefy easily, the harder parts being ejected. The ejection of the chewn residue of fruit was undoubtedly one of the points which gave rise to the popular belief quoted above, plus the fact that the bat hangs head downwards—perhaps a natural conclusion to the ignorant mind. Here we have a legend based on a crude observation which needs explanation.

Blanford (*loc.cit.*, p. 258) in a footnote writes, 'They are also fond of the fruit of *Terminalia catappa*, and are said by Day to extract the kernels, often utilizing the verandahs of houses as a resort while thus engaged, and alarming the inhabitants by sounds suggestive of house-breaking.' W. F. Sinclair in the *Journal* (vol. vii, p. 544) writes, 'Dr. Day's observation has been verified by two seasons' experience of burglarious bats at Tanna. When the tree is out of fruit the bats are "not-a-burgling".' That these bats do eat the fruit of *Terminalia catappa* I have had ample proof, that is, they suck out the juice and discard the hard portions. Often in their attempts to extract the juice they bite through the stones but they do not eat the kernels. Both the kernels and the seed coats will be found on the ground. In the morning Palm Squirrels feed on the kernels. With regard to these bats entering houses I have no evidence—I am doubtful whether they ever do. However, this point needs further confirmation.

In my note on the fertilization of *Grevillea robusta* A. Cunn. in this *Journal* (xxxvi, p. 763) I remarked 'It seems extraordinary that so large an animal could survive for several weeks on nectar alone . . .' This observation led me to investigate the food of these bats and examine the stomach contents of several specimens. A doubt arose in my mind as to whether these bats really ate the whole fruit or only extracted the juice and discarded the remains. It is common knowledge that the Flying-Fox and other fruit bats cause tremendous damage in orchards and perhaps rightly deserve to be relegated to the list of animals and birds harmful to crops. However, at the same time I do not for a moment suggest that they should be exterminated. We have yet to learn whether these 'destroyers' are not also beneficial.

My first subjects for dissection were naturally the specimens mentioned in my note quoted above. I expressed my doubts and views to Mr. Humayun Ali and asked him to keep a lookout for specimens, to dissect them and report the results to me. On the 31st August (1933) he wrote to me as follows:—'Yes, eventually I did manage to get down to Belapur (Ahmednagar District) and to the "battery". I shot five of them one morning and was glad to find that you were right. The stomach held no solid stuff whatever, not even seeds. The intestines were full of white, milky slime and one of the bats had a lot of dark viscous liquid in the stomach.' His statement supports my view.

Some time later, Dr. Laud, Superintendent of the Victoria Gardens, kindly sent me five specimens from the Byculla colony for dissection. These examples were shot early in the morning when to all reasonable expectation the stomachs should have been loaded. On dissection these animals were found to be extremely fat and well conditioned. Examination of the stomachs revealed nothing beyond a small quantity of viscous fluid. The intestines contained a similar liquid, but in the lower end of the intestines this fluid was yellowish brown, turning brown towards the extremity. In a single instance did I find five minute seeds of a fig in the stomach but none in the intestines. Surely, if these animals had eaten any solid food during the night, it would have betrayed itself in the lower end of the alimentary canal? However, this was not the case. Another point of interest is that none of the specimens dissected by me contained any large parasites either in the stomach or in the intestines.

Subsequent dissections of these animals have yielded the same results. Hence I think it is quite reasonable to conclude that Flying-Foxes subsist on liquid or semi-liquid foods, namely fruit juices and nectar and such fruit that are readily soluble. I have frequently observed these bats feeding on the nectar of the Silk Cotton Tree (*Bombax malabaricum*) besides the nectar from the flowers of the *Grevillea*. Beside the cultivated fruit trees I have observed them feeding on the following plants:—

*Ficus bengalensis*, L.
*Ficus glomerata*, Roxb.
*Ficus infectoria*, Roxb.
*Ficus mysorensis*, Heyne.
*Ficus religiosa*, L.
*Ficus retusa*, L.
} (Ripe fruit).

The Flying-Fox probably attacks the fruit of all the members of this genus.

*Polyalthia longifolia*, Bth. & Hk. f. (Ripe fruit).
*Bombax malabaricum*, DC. (Nectar from the flowers).
*Calophyllum inophyllum*, L. (Ripe fruit).
*Bassia latifolia*, Roxb. (Ripe fruit).

*Grevillea robusta*, A. Cunn. (Nectar from the flowers).
*Terminalia catappa*, L. (Ripe fruit).

I have never known Flying-Foxes to feed on the fruit of the genus *Zyziphus*, this is probably due to the strongly armed nature of these trees. The menu of this bat is undoubtedly by far larger than what I have given.

Knud Anderson, in his *Catalogue of the Chiroptera in the Collection of the British Museum* (2nd. ed.) vol. i, p. 328 describing the feeding habits of the Flying-Fox writes, 'On captive specimens it has been observed that they chew the figs, until they have extracted the juice, when the remaining pulp is ejected out of the mouth; glutinous and farinaceous food, such as plantains, they do not serve in this manner.' In these few lines we observe what I have stated above. If this is true of specimens in captivity why should it not also apply to the animals in the natural state? The habit of the Flying-Fox of ejecting the solid portions of the fruit it eats accounts for the large amount of litter found under the trees where they have been feeding.

*Miscellaneous.*—Indians consider the fat of these animals very efficacious in cases of rheumatism (like tiger and other fats) and for baldness. It is also said that the bone from the wing of a flying-fox tied to the ankle with hair from the tail of a black cow will ensure painless childbirth. I am not in a position to vouch for the truth of this statement!

# THE FLORA OF WAZIRISTAN.

BY

E. Blatter, S.J., Ph.D., F.L.S., and J. Fernandez.

## PART III.

(*Continued from page 977 of vol.* xxxvi).

(*With two plates*).

## CAESALPINIACEAE.

### Cassia Tourn. ex L.

400 species.—Tropics and warm temperate regions.

**Cassia sophera** L. Sp. Pl. (1753) 379.
*Locality*: Waziristan (Duthie's Collect. 15734).
*Distribution*: In most tropical countries, probably of American origin.

### Ceratonia L.

1 species.—Mediterranean.

***Ceratonia siliqua** L. Sp. Pl. 1026.
*Vernacular name*: Carob Tree.
*Locality*: *N.W.*: Miram Shah (B. & F. 46 !).
*Distribution*: E. Mediterranean region.

## MIMOSACEAE.

### Prosopis L.

30 species.—Tropics and subtropics.

**Prosopis Stephaniana** Spreng. Syst. ii, 726.
*Locality*: *Tank* (Stewart).
*Flowers*: April 1860 (Tank).
*Distribution*: Peshawar, Afghanistan, Orient, Mediterranean.

### Acacia (Tourn.) L.

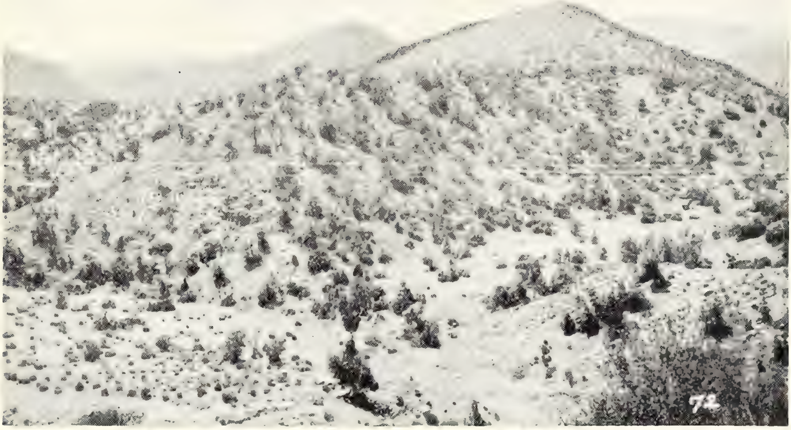
550 species.—Tropics and subtropics.

**Acacia arabica** Willd. Sp. Pl. iv (1805) 1085.
*Locality*: *Tank*: City of Tank, abundant (Stewart).
*Distribution*: India, Ceylon, Arabia, Egypt, tropical Africa, Natal.

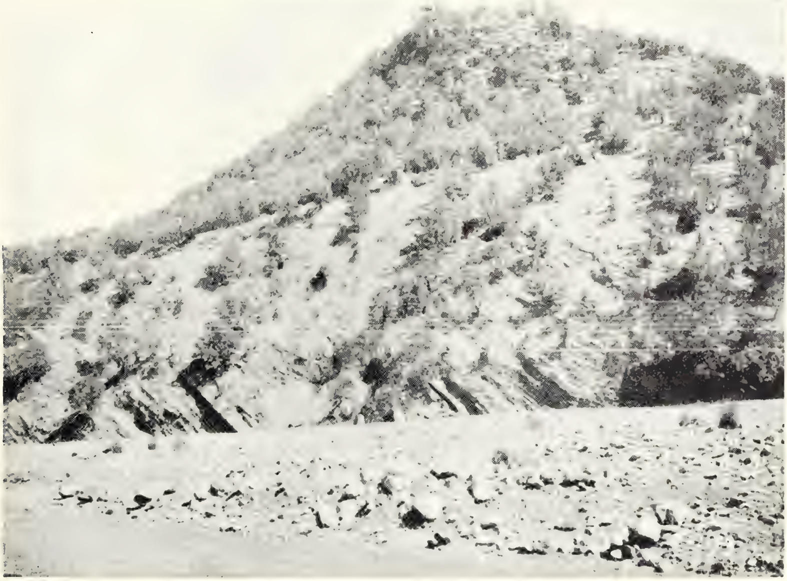
**Acacia Farnesiana** Willd. Sp. Pl. iv (1805) 1083.
*Vernacular name*: Walayti kikar (Hind).
*Locality*: *N.W.*: Miram Shah, cultivated (B. & F. 27 !).
*Tank* (Stewart).
*Flowers & Fruit*: 19-3-30 (Miram Shah).
*Flowers*: April 1860 (Tank).
*Distribution*: Indigenous in America, naturalized throughout India and Burma.

**Acacia Jacquemontii** Benth. in Hook. Journ. Bot. i, 409.
*Locality*: *S.W.*: Above Palosina (Stewart).
*Distribution*: Punjab plains and Outer Himalaya up to 3,000 ft., Gujarat, Rajputana, Sind, Baluchistan, Trans-Indus.

**Acacia modesta** Wall. Pl. As. Rar. ii (1831) 27, t. 130.
*Vernacular name*: Palessa, Palosa (Waziri), Pulosa.
*Locality*: *N.W.*: Miram Shah, 3,000 ft. (F. 947 ! 1397 ! 1398 !, B. & F. 3 !).—Boya, 4,000 ft. (F. 1515 !), open stony plain (F. 4350 !).—Razani,



8. Near Razani due West. Mostly *Quercus ilex* L. *Olea cuspidata* Wall. and *Sophora mollis* Grah.



9. Right bank of Khunai River above Dossali Fort with *Olea cuspidata* Wall., *Monotheca buxifolia* Dcne.; *Sophora mollis* Grah. and grass.

*Photos by J. Fernandez.*

5,000 ft. (Stewart).—Siroba (Stewart).—Above Khirgi (Stewart).—Spinwam, 2,650 ft. (B. & F. 959 !).—Shewa Post, bank of Volam River (B. & F. 886 !).

*S.W.*: Palosina (Stewart).—Sarwekai, common on hills and here and there in stony plain, 3,200 ft. and higher (F. 3954 !).—Jandola, open stony ground and nalas, 2,200 ft. (F. 668 ! 676 ! 696 ! 4206 !).—Dargai Post, on hillsides (F. 3721 ! 3722 ! 3723 !).—Sararogha, 4,000 ft. (F. 179 ! 180 ! 594 ! 598 ! 614 !), in dry nala W. of Camp and along dry stony slopes in the nala area (F. 597 !).

*Tank*: Near Tank (J. Williams !).—Zam Valley, N.-W. of Tank (Stewart !).

*Flowers*: April, May.

*Fruit* of previous year still on tree in March.

*Distribution*: Baluchistan, Salt Range, Sind Sagar Doab, Sub-Himalayan tract and Outer Himalaya from the Jumna westwards to 4,000 ft.

**Acacia eburnea** Willd. Sp. Pl. iv (1805) 1081.—*Mimosa eburnea* Roxb. Corom. Pl. t. 199.

*Locality*: *S.W.*: Sararogha, dry nalas W. of Camp, along dry stony slopes in nala area, 4,000 ft. (F. 147 ! 150 ! 584 ! 595 !).—Jandola, open stony ground and nalas, 2,270 ft. (F. 674 ! 677 !).

*Fruit*: May.

*Distribution*: Arabia, Afghanistan, Baluchistan, Salt Range, Sub-Himalayan tract and outer valleys, up to 3,000 ft., east as far as Oudh, Sind, Deccan, Ceylon. (Parker says that it does not occur in the Punjab).

## SAXIFRAGACEAE

750 species.—Cosmopolitan, chiefly temperate.

### *Saxifraga (Tourn.) ex L.

325 species.—N. temperate, Arctic, Andes, chiefly alpine.

***Saxifraga Petraschii** Sünderm. = *S. tombeanensis* Boiss. × *S. Rocheliana* Sternb.

*Locality*: *S.W.*: Razmak, in garden (B. & F. !).

*Flowers*: April.

*Distribution*: Parents from S. Tyrol, N. Italy and Bosnia, N. Albania respectively.

### Bergenia Moench.

10 species.—E. Asia.

**Bergenia ligulata** Engl. in Bot. Zeitg. xxvi (1868) 840.—*Saxifraga ligulata* Wall. in As. Res. xiii, 398.

*Vernacular name*: Kamargul (Waziri).

*Locality*: *S.W.*: Near Kaniguram, about 6,500 ft. (Stewart).—Pre Ghal (J. Williams 7816 !).—Shuidar, 9,000-11,000 ft. (F. 2541 !); 7,000-8,000 ft., between rocks together with *Selaginella* and ferns (F. 1557 !).—Razmak (F. 1798 !).

*Flowers*: 18-4-30, 8-5-27 (Shuidar); 8-8-1888 (Pre Ghal); September 1860 (Kaniguram).

*Distribution*: Temperate Himalaya, from Kashmir to Bhutan, 7,000-10,000 ft., Khasia Hills, Kuram Valley.

**Bergenia Stracheyi** (Hook. f. & Th.) Engl. in Bot. Zeitg. (1868) 842.—*Saxifraga Stracheyi* Hook. f. & Th. in Journ. Linn. Soc. ii (1858) 61.

*Locality*: *S.W.*: Pre Ghal (Duthie's Collect. 15608 !).

*Flowers*: 17-5-1895 (Pre Ghal).

*Distribution*: W. Himalaya, from Kashmir to Kumaon, 8,000-14,000 ft. Afghanistan.

### Parnassia (Tourn.) L.

25 species.—N. temperate region, chiefly in mountain bogs.

**Parnassia nubicola** Wall in Wight Ill. t. 21.

*Locality*: *S.W.*: Pre Ghal (Hay).

### RIBES L.

60 species.—N. temperate and Andes.

**Ribes orientale** Desf. Hist. Arb. ii (1809) 88; Boiss. Fl. Or. ii (1872) 817.
*Locality*: *S.W.*: Razmak, 6,500 ft. (F. 1606 ! 1608 ! 1646 !).—Shuidar 11,000 ft. (F. 2474 !).
*Young leaves*: 8-5-27 (Razmak).
*Distribution*: Afghanistan, Kuram Valley, Baluchistan, Kashmir, inner arid Himalaya, 8,000-12,000 ft., Lahul, Kunawar, Kumaon, West Tibet, mountains of Greece and W. Asia.

## CRASSULACEAE.

450 species.—Cosmopolitan, chiefly S. Africa.

### SEDUM Tourn. ex L.

150 species.—N. temperate.

**Sedum adenotrichum** Wall. Cat. 7231.
*Locality*: *S.W.*: In the upper regions (Stewart).—N. of Razmak, below Springs, 7,700 ft. (B. & F. 1801 ! 1870 !).—Slopes of Shuidar, 9,000-11,000 ft. (F. 1546 !).
*Flowers & Fruit*: 18-4-30 (Shuidar); 25-4-30 (Razmak); 8-5-27 (N. of Razmak).
*Distribution*: W. Himalaya, Kashmir to Kumaon, 3,000-8,000 ft., Afghanistan 11,000 ft.

**Sedum Ewersii** Ledeb. Fl. Alt. ii, 191.
*Locality*: *S.W.*: Pre Ghal (Hay).
*Distribution*: Temperate and alpine Himalaya, 9,000-17,000 ft., alpine Siberia, Soongaria.

**Sedum adenocalyx** Blatter *sp. nov.* [*Crassulacea. Refert S. adenotrichum* Wall. *sed facile distinguitur pedicellis brevissimis* (1-1.5 *mm.*), *sepalis oblongo-linearibus obtusis, extus dense glanduloso-pubescentibus, petalis ovato-acuminatis vel cuspidatis sepala paullum tantum superantibus, seminibus lineari-oblongis, laevibus.*]

*Perennis* (?), *pluricaulis, caules steriles abbreviatos emittens. Caules crassi, carnosi, ascendentes usque ad 8 cm. alti, dimidia parte superiore dense glanduloso-pubescentes. Folia crassa, complanata, glabra, radicalia laxe rosulata spathulata, apice obtusa vel subacuta, ad 16 mm. longa et 4 mm. lata, caulium sparsa, forma radicalium, ad 10 mm. longa et 3 mm. lata, sensim breviora et angustiora, caulium sterilium abbreviata. Panicula brevis, tota dense glandulosa-pubescens, cymis 2-3-floris bracteatis constans; pedicelli brevissimi,* 1-1.5 *mm. longi. Flores 3 mm. longi. Sepala libera fere ad basin, oblongo-linearia, attenuata versus apicem, obtusa, extus dense glanduloso-pubescentia,* 2.5 *mm. longa, ca. 1 mm. lata. Petala albida, libera fere ad basin, ovato-acuminata vel cuspidata, sepala paullum superantia, intus glabra, extus nervo medio parce glanduloso-pubescentia. Stamina 10, 5 breviora. Carpella 5, erecta, pallide brunnea, ovato-acuminata, apice capitatula. Semina multa minima, pallide brunnea, lineari-oblongo, ad basin et apicem rotunda, laevia, glabra.*

Perennial (?), several-stemmed, giving off abbreviated sterile stems. Stems stout, fleshy, ascending, up to 8 cm. high, upper half densely glandular-pubescent. Leaves fleshy, flat, glabrous, radical ones rosulate, spathulate, obtuse or subacute at the apex, up to 16 mm. long and 4 mm. broad, stem-leaves not very dense, resembling the radical leaves in shape, up to 10 mm. long and 3 mm. broad, getting slowly narrower and shorter, leaves of sterile stems abbreviated. Panicle short, the whole glandular-pubescent, consisting of 2-3-flowered bracteate cymes; pedicels very short, 1-1.5 mm. long. Flowers 3 mm. long. Sepals free almost to the base, oblong-linear, attenuate towards the apex, obtuse, outside densely glandular-pubescent, 2.5 mm. long, ca. 1 mm. broad. Petals whitish, free almost to the base, ovate-acuminate or cuspidate, slightly longer than the sepals, inside glabrous, outside along the midvein sparingly glandular-pubescent. Stamens 10, 5 shorter. Carpels 5, erect, pale brown, ovate-acuminate, at the apex a small head. Seeds small, many, pale brown, linear-oblong, rounded at the base and apex, smooth, glabrous.

*Locality*: *N.W.*: Loargai Narai, in wooded ravine, together with mosses and lichens, 6,600 ft. (B. & F. 1307 ! type, 1307a ! cotype).
*Flowers & Fruit*: 16-4-30.

## MYRTACEAE.

2,800 species.—Warm regions, chief centres Australia and tropical America.

### *PSIDIUM L.

110 species.—Tropical America, W. Indies.

***Psidium Guyava** L.
*Vernacular name*: Guava.
*Locality*: *S.W.*: Razmak, in garden (B. & F. !).
*Distribution*: Indigenous in Mexico.

### *MYRTUS (Tourn.) L.

70 species.—Tropics and subtropics.

***Myrtus communis** L.
*Vernacular name*: The Myrtle.
*Locality*: *N.W.*: Miram Shah (B. & F. !).
*Distribution*: S. Europe, extending to Afghanistan.

### *CALLISTEMON R. Br.

12 species.—Australia.

* **Callistemon lanceolatus** DC. Prodr. iii, 223.
*Vernacular name*: Bottle Brush Tree.
*Locality*: *N.W.*: Miram Shah (B. & F. 32 !).
*Flowers*: 19-3-30 (Miram Shah).
*Distribution*: Indigenous to Queensland and New South Wales.

### *EUCALYPTUS L'Herit.

230 species.—Australia, 2 or 3 Indo-Malaya.

***Eucalyptus rostrata** Schl. in Linnaea xx (1847) 655.
*Locality*: *N.W.*: Miram Shah, garden (F. 2367 !).
*Flowers*: 12-4-27.
*Distribution*: Indigenous to all the states of Australia, mainly inland.

***Eucalyptus sp.**
*Locality*: *N.W.*: Miram Shah Fort, garden, 3,150 ft. (B. & F. 40A !).
*Flowers*: 19-3-30 (Miram Shah).

## PUNICACEAE.

2 species.—Socotra, from the Balkans to the Himalayas, and cultivated.

### PUNICA (Tourn.) L.

**Punica granatum** L. Sp. Pl. (1753) 472.
*Vernacular name*: Narghesa (Waziri).
*Locality*: *N.W.*: Razani, in jungle amongst rocks, 5,000 ft. (F. 2072 ! 2087 ! 2088 !).—Miram Shah (F. 346 !).—Dwa Warkha, abundant (Stewart).—Spinwam (B. & F. 798 !).—Boya, 4,000 ft., cultivated (F. 1348 ! 1352 !).—Shewa Post (B. & F. 909 !).
*S.W.*: Sararogha, stony hillside, 4,000 ft. (F. 166 !).—Wana, 4,500 ft., cultivated (F. 3552 ! 3553 !).—Barrarra Pass, growing wild (Stewart).
*Flowers*: May.
*Distribution*: Indigenous in Persia, Afghanistan, Baluchistan, Hazara and Himalaya, 3,000-6,000 ft. Elsewhere cultivated,

## LYTHRACEAE.

500 species.—All zones but frigid.

### AMMANNIA (Houst.) L.

20 species.—Cosmopolitan.

**Ammannia verticillata** Lam. Encycl. i (1783) 131 *et* Ill. i (1791) 312, t. 77, f. 3; Boiss. Fl. Or. ii (1872) 743; *excl. synon.*—*A. salicifolia* Monti Comm. Acad. Bonon. v, I Opusc. (1767) 112 *cum tab.*; Sabnis Fl. Sind (1923-24) 30.
*Locality*: *S.W.*: Dargai Post, along stream (F. 3742 !).
*Flowers*: June.
*Distribution*: Italy, Montenegro, Lycia, Syria, Kurdistan, Transcaucasus, Persia, Afghanistan, Sind.

**Ammannia sp.**
*Locality*: *N.W.*: Datta Khel, along canals, 4,500 ft. (F. 1222 !).

## ONAGRACEAE.

500 species.—Temperate and tropical regions.

### EPILOBIUM Dill. ex L.

160 species.—Temperate and arctic regions.

**Epilobium angustifolium** L. Sp. Pl. 347.
*Locality*: *S.W.*: Pre Ghal (Hay !).—Razmak, planted (B. & F. !).
*Distribution*: Temperate W. Himalaya, 8,000-12,000 ft., Orient, Europe, N. America.

**Epilobium minutiflorum** Haussk. in Oest. Bot. Zeitschr. 29 (1879) 55.
*Locality*: *S.W.*: Pre Ghal (Hay).
*Distribution*: Syria.

## CUCURBITACEAE.

750 species.—Chiefly tropics.

### CUCUMIS (Tourn.) L.

25 species.—Tropics and subtropics.

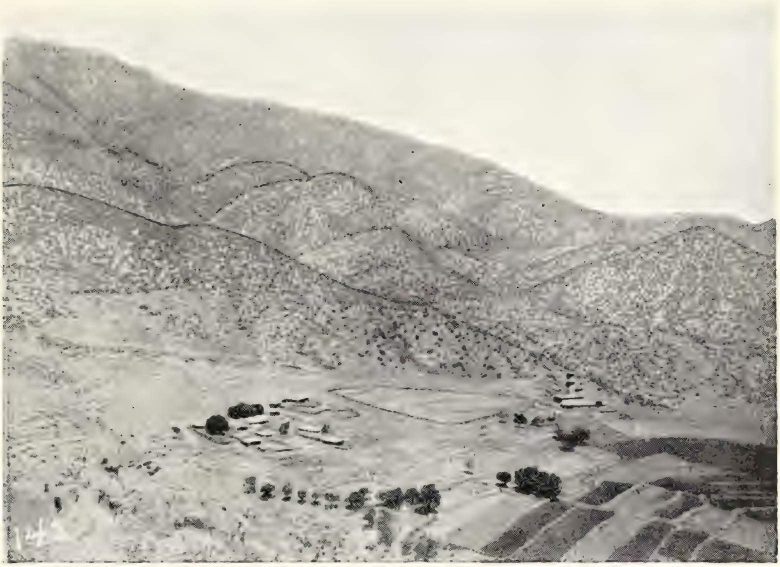
**Cucumis prophetarum** L. Cent. Amoen. Academ. 4 (1759) 295; Boiss. Fl. Or. ii (1872) 758.
*Vernacular name*: Khatkai (Waziri).
*Locality*: *S.W.*: Wana, near stream, S.-E. of Camp, 4,500 ft. (F. 3593 !), stony plain (F. 3468 !).
*Flowers*: June.
*Distribution*: Egypt, Nubia, Abyssinia, Kordofan, Arabia, Socotra, Baluchistan, Sind, Rajputana Desert.

**Cucumis melo** L. Sp. Pl. 1011.
*Popular name*: Melon.
*Locality*: *S.W.* (J. Williams 7146 !).
*Flowers*: 4-5-1888.
*Distribution*: Origin uncertain. De Candolle considers it to be probably a native of N.-W. India, Baluchistan and perhaps tropical Africa.

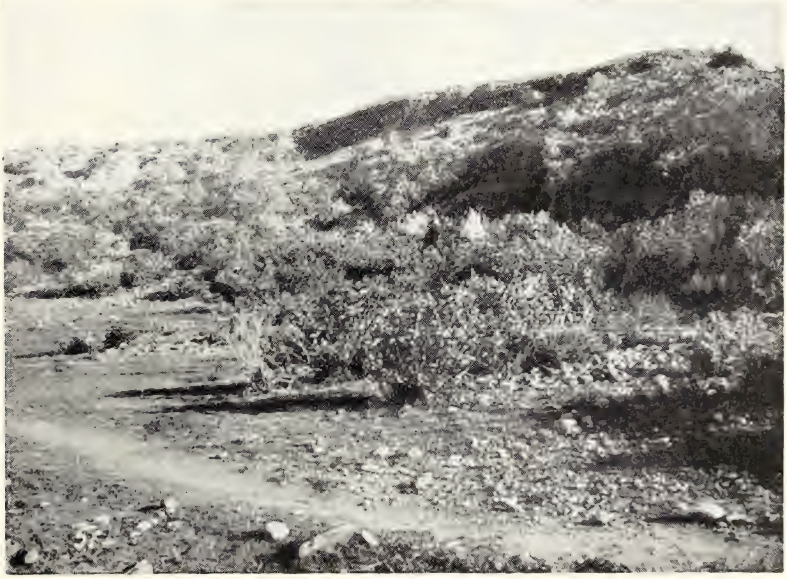
### CITRULLUS Forsk.

4 species.—Africa, Mediterranean, tropical Asia.

**Citrullus colocynthis** Schrad. in Linnaea xii (1838) 414; Boiss. Fl. Or. ii (1872) 759.—*Cucumis colocynthis* L. Sp. Pl. (1753) 1011.
*Vernacular name*: Colocynth gourd; Madagini (N. Waziristan), Madaigini (S. Waziristan).
*Locality*: *N.W.*: Miram Shah, open stony ground, 3,000 ft. (F. 318 ! 441 ! 442 ! 464 ! 672b !), sandy banks of Tochi (F. 369 !).—E. of Spinwam



10. Looking across Dirdoni village from below Alexandra Picket. Note the dense growth of *Quercus ilex* L. on the ranges.



11. Almost pure formation of *Adhatoda vasica* Nees in a side nala of Kaitu River at Spinwam Fort.

*Photos by J. Fernandez.*

Fort, sandstone nala (B. & F. 672 !).—Chasmai River, bed, 3,100 ft. (B. & F. 346 !).

*S.W.*: (Duthie's Collect. 15737 !).—Sararogha, stony plain, 4,000 ft. (F. 43 ! 195 ! 200 !).—Jandola, stony ground, 2,200 ft. (F. 660 !), dry slopes on Tank River (F. 770 !).—Sarwekai, stony plain, 3,200 ft. (F. 3928 !). —Pre Ghal (J. Williams 7820 !).

*Distribution*: Spain, Canaries, Cape Verde Islands, N. Africa, Arabia, Palestine, Mesopotamia, Persia, Afghanistan, Baluchistan, Punjab, Sind, Indian Desert, India, Ceylon.

## FICOIDACEAE.

(*Aizoaceae.*)

650 species.—Chiefly S. Africa but also in California, S. America, tropical Africa and Asia, Australia.

### TRIANTHEMA L.

13 species.—Tropics.

**Trianthema pentandra** L. Mant. (1767) 70.
*Locality*: *Tank*: At and near Tank (J. Williams 7823 ! 7964 !).
*Flowers*: 5-6-1888 (Tank).
*Fruit*: 4-5-1888 (Tank).
*Distribution*: Sind, Rajputana Desert, Punjab, Baluchistan, tropical Africa.
*Uses*: Leaves used as poultice in guinea worm (Williams).

### ORYGIA Forsk.

1 species.—Africa to India.

**Orygia decumbens** Forsk. Fl. Aeg.-Arab. (1775) 103.
*Locality*: *N.W.*: Dwa Warkha (Stewart).
*Distribution*: Sind, Baluchistan, Punjab, Rajputana, Mysore, Coimbatore, W. Asia, Africa.

### MOLLUGO L.

15 species.—Tropics and N. America.

**Mollugo pentaphylla** L. Sp. Pl. (1753) 89.—*M. stricta* L. Sp. Pl. ed. ii (1762) 131.
*Locality*: *Tank* (J. Williams 7127 !).
*Flowers*: 9-5-1888 (Tank).
*Distribution*: Throughout India and Ceylon, eastwards to Malay Peninsula, China, Japan, Fiji.

## ARALIACEAE.

700 species.—Chiefly tropical, especially Indo-Malayan, tropical America.

### HEDERA Tourn. ex L.

5 species.—Temperate regions.

**Hedera Helix** L. Sp. Pl. (1753) 202.—*H. himalaica* Tobler Die Gattung Hedera (1912) 67-79.
*Vernacular name*: Parvatiae (Waziri).
*Locality*: *N.W.*: Razmak Narai, on slope of ravine, 7,000 ft. (B. & F. 1227 !).

*S.W.*: N. of Razmak, below Springs, on rocks and trees, 7,700 ft. (B. & F. 1842 !, F. 1769 ! 1873 ! 2315 !).

*Distribution*: Throughout the Himalaya 6,000-10,000 ft., Khasia, from W. Europe to Japan.

## CAPRIFOLIACEAE.

275 species.—Temperate regions and tropical mountains.

### VIBURNUM L.

110 species.—Temperate and subtropical regions, especially Asia, N. America.

**Viburnum cotinifolium** D. Don Prodr. Fl. Nep. (1825) 141.
*Locality*: *S.W.*: Kaniguram, about 8,200 ft. (Stewart).—Razmak (F. 1861 ! 1906 !).—N.-E. of Razmak (Stewart).
*Flowers*: May.
*Distribution*: Himalaya, 4,000-11,000 ft., Trans-Indus to Bhutan.

### ABELIA R. Br.

15 species.—Asia, Mexico.

**Abelia triflora** R. Br.: **var. parvifolia** C. B. Clarke in Hook. f. Fl. Brit. Ind. iii (1880) 9.
*Locality*: *S.W.*: Kaniguram, 6,500 ft. (Duthie's Collect. 15793 !, Stewart).
*Flowers*: 18-5-1895 (Kaniguram).
*Distribution*: Himalaya, 5,000-10,000 ft., from the Indus eastwards.

### LONICERA L.

100 species.—N. hemisphere.

**Lonicera obovata** Hook. f. & Th. in Journ. Linn. Soc. ii, 169.
*Locality*: *S.W.* (Duthie's Collect. 15796 !).
*Distribution*: Temperate Himalaya, from Kashmir to Kumaon, 8,000-13,000 ft., Sikkim, 12,000-14,000 ft.

**Lonicera quinquelocularis** Hardw. in As. Res. Soc. Beng. vi (1799) 351.
*Vernacular name*: Pastavaniae, Galashanki (Waziri).
*Locality*: *S.W.*: Near Kaniguram, about 8,200 ft. (Stewart).—Razmak (F. 1864 ! 1915 ! 3104 ! 3341 !).
*Distribution*: N.-W. Himalaya, Baluchistan, Kuram Valley, Bhutan, China.

***Lonicera sp.**
*Locality*: *N.W.*: Miram Shah Fort, Officers' Garden (B. & F. 528 !).
*Flowers*: 28-3-30.

**Lonicera sp.**
*Locality*: *S.W.*: Kaniguram (Stewart).

## RUBIACEAE.

5,500 species.—Mostly tropical, a number temperate.

### RANDIA Houst. ex L.

125 species.—Tropics.

**Randia tetrasperma** Benth. & Hook. f. in Gen. Pl. ii (1873) 88.—*Gardenia tetrasperma* Roxb. Fl. Ind. i (1832) 709.
*Locality*: *S.W.*: Barrarra Pass, not uncommon (Stewart).
*Distribution*: Salt Range and subtropical Himalaya from Kashmir eastwards, ascending to 4,000-6,000 ft. in Kumaon and to 7,000 ft. in Sikkim and Bhutan, Assam, Sylhet.

### GAILLONIA A. Rich.

12 species.—Nubia to India.

**Gaillonia hymenostephana** Jaub. & Sp. Ill. Pl. Or. i (1842) 146, t. 79.
*Locality*: *S.W.*: Wana, 4,500 ft. (Duthie's Collect. 15786 !), 3,500 ft. (Stewart ex J. D. Hooker).—Barwand, 4,000 ft. (Duthie's Collect. 15779 !).
*Flowers*: 21-4-1895 (Barwand), 17-5-1895 (Wana).
*Distribution*: Punjab, Baluchistan, Afghanistan, Arabia.

### RUBIA (Tourn.) L.

15 species.—Europe, Asia, America.

**Rubia cordifolia** L. Syst. ed. xii, 229.
*Vernacular name*: Warwaga (Williams).
*Locality*: *S.W.*: 8 miles below Kaniguram village (Stewart).—Pre Ghal (J. Williams 7832 !).—Razmak, towards springs, 6,750-7,300 ft. (B. & F. 1767 !, F. 1882 !).
*Fruit*: 11-8-1888 (Pre Ghal).
*Distribution*: Throughout the hilly districts of India, from the N.-W. Himalaya to Ceylon and Malay Peninsula, Dahuria to Japan and Java, tropical Africa.

**Rubia infundibularis** Hemsl. & Lace in Journ. Linn. Soc. xxvii (1891) 324.
*Locality*: *S.W.*: Pre Ghal (J. Williams 7833 !).
*Fruit*: 1-8-1888 (Pre Ghal).
*Distribution*: Baluchistan, Afghanistan.

**Rubia albicaulis** Boiss. Diagn. ser. 1, iii, 53, **var. stenophylla** Boiss. Fl. Or. iii, 19.
*Locality*: *S.W.*: (J. Williams 9155 !).—Kaniguram, 6,500 ft. (Duthie's Collect. 15770 !).
*Flowers*: 14-5-1895 (Kaniguram).
*Fruit*: 6-7-1888 (S. Waz.).
*Distribution*: Persia, Afghanistan.

### GALIUM L.

250 species.—Cosmopolitan.

**Galium aparine** L. Sp. Pl. 108; Boiss. Fl. Or. iii, 68.
*Vernacular name*: Babrezie (Waziri).
*Locality*: *N.W.*: Razani (Stewart).—Datta Khel Fort, stony plain 4,600 ft. (B. & F. 1331 !).—4 miles E. of Datta Khel, on gravel (B. & F. 601 ! 605 !).—Boya, 3,550 ft. (B. & F. 86 !).—Miram Shah (F. 507 !), hills E. of caves, 3,600 ft. (B & F. 533 !).—Dossali Fort, nala, among tufts of grass (B. & F. 1022 !), right bank of Khaisora River (B. & F. 1163 !).
*S.W.*: Near Kaniguram (Stewart).—Lower slopes of Shuidar, up to 5,700 ft. (B. & F. 1615 !).—Razmak, stony plain (F. 3187 !).
*Flowers & Fruit*: 21-3-30 (Boya); 30-3-30 (Datta Khel); 10-4-30 (Dossali); 13-4-27 (Miram Shah); 16-4-30 (Datta Khel); 18-4-30 (Shuidar); 5-5-27 (Razmak).
*Distribution*: Temperate Himalaya up to 12,000 ft., from Kashmir to Sikkim, N. and W. and Central Asia, N. Africa, Europe.

**Galium tricorne** Stokes in With. Bot. Arr. Brit. Pl. ed. II, i, 153.
*Vernacular name*: Chapreth (Waziri).
*Locality*: *N.W.*: Datta Khel (F. 1253 !), in garden, 4,600 ft. (B. & F. 1387 !).—Dossali, nala (B. & F. 1062 !).
*S.W.*: (Stewart).—Razmak, stony plain (F. 2683 !).
*Flowers & Fruit*: 25-3-27 (Datta Khel); 11-4-30 (Dossali); 17-4-30 (Datta Khel); 29-4-27 (Razmak).
*Distribution*: W. Himalaya, Orient, Europe, N. Africa.

**Galium spurium** L. Sp. Pl. (1753) 154.
*Locality*: *S.W.*: Razmak, stony plain, 6,800 ft. (B. & F. 1748a !).
*Flowers & Fruit*: 24-4-30 (Razmak).

**Galium setaceum** Lam. Encycl. ii, 584; Boiss. Fl. Or. iii, 77.—*G. capillare* Cav. Ic. t. 191, f. 1.
*Locality*: *S.W.*: Wana, 4,500 ft. (Duthie's Collect. 15784 !).
*Flowers*: 5-5-1895 (Wana).
*Distribution*: Temperate Asia, Punjab, Baluchistan, Afghanistan, Mediterranean.

**Galium sp.**
*Locality*: *S.W.*: (Duthie's Collect. 15615).

CALLIPELTIS Stev.

3 species.—Egypt to Persia.

**Callipeltis cucullaria** DC. Prodr. iv, 613.
*Vernacular name*: Packikt boti (Williams).
*Locality*: *S.W.*: Shaur Hill (J. Williams 2591 !).—Wana (Duthie's Collect. 15629 !).
*Flowers*: 1-5-1895 (Wana).
*Distribution*: Baluchistan, Afghanistan, Persia, Orient, Asia Minor, Mediterranean, N. Africa.

## VALERIANACEAE.

350 species.—Europe, Asia, Africa, America.

VALERIANA Tourn. ex L.

200 species.—Europe, Asia, Africa, America.

**Valeriana Wallichii** DC. Mem. Valer. 15, t, 4.
*Vernacular name*: Kamargul (Waziri).
*Locality*: *S.W.*: Razmak.—Pre Ghal (J. Williams 7834 ! 7835 !, Duthie's Collect. 15604 !).
*Flowers*: May, 16-5-1895 (Pre Ghal).
*Fruit*: 9-8-1888; 14-8-1888 (Pre Ghal).
*Distribution*: Afghanistan, Kuram Valley, temperate Himalaya from Kashmir to Bhutan, 10,000 ft., Khasia Hills, 4,000-6,000 ft.

**Valeriana dioica** L. Sp. Pl. 44.
*Locality*: *S.W.*: (Duthie's Collect. 15643 !).
*Distribution*: Europe, Central Russia, Asia Minor.

**Valeriana sp.**
*Locality*: *S.W.*: Upper regions (Stewart).

VALERIANELLA Tourn. ex Hall.

50 species.—N. temperate regions.

**Velerianella Szovitziana** Fisch. & Mey. Ind. Sem. iii, Petrop. 48.
*Locality*: *N.W.*: Left bank of Dariawasti Algad (B. & F. 1662 !).—N. of Boya Fort near Tochi River, 3,550 ft. (B. & F. 1693 !).—Near Miram Shah, bed of Chasmai River, 3,100 ft. (B. & F. 317 !).
*S.W.*: Slopes of Shuidar, 7,000-9,000 ft. (B. & F. 1593 !).—Barwand, 4,000 ft. (Duthie's Collect. 15775 !).—Near Kaniguram, about 6,500 ft. (Stewart).
*Flowers* & *Fruit*: 24-3-30 (Chasmai River); 18-4-30 (Shuidar); 19-4-30 (Dariawasti Algad); 21-4-30 (Boya).
*Fruit*: 26-4-1895 (Barwand).
*Distribution*: Kashmir, Afghanistan, Persia, Arabia, Syria, Asia Minor.

## CAMPANULACEAE.

1,000 species.—Temperate and subtropical regions.

CAMPANULA (Tourn.) L.

300 species.—N. temperate regions and tropical mountains, especially Mediterranean.

***Campanula Medium** L. Sp. Pl. 167.
*Vernacular name*: Canterbury Bells.
*Locality*: *S.W.*: Razmak, in garden (B. & F. !).
*Distribution*: S. Europe.

**Campanula leucoclada** Boiss. Diagn. ser. 2, iii, 109.—*C. Griffithii* Hook. f. & Th. in Journ. Linn. Soc. ii (1858) 22.
*Locality*: *S.W.*: Wana, 4,500 ft. (Duthie's Collect. 15787 !).

*Flowers*: 8-5-1895 (Wana).
*Distribution*: Afghanistan, Baluchistan, Kuram Valley.

**Campanula sp.** near *C. sylvatica* Wall.
*Locality*: *S.W.*: (Duthie's Collect. 15771 !).

**Campanula sp.**
*Locality*: *S.W.*: Kaniguram (Stewart).

## PLUMBAGINACEAE.

280 species.—Cosmopolitan, especially on salt steppes and seacoast.

### ACANTHOLIMON Boiss.

80 species.—E. Mediterranean (desert plants).

**Acantholimon sp.**
*Vernacular name*: Drab (Waziri).
*Locality*: *N.W.*: Near Datta Khel village, 4,600 ft., on gravel, forming a low mat several feet in diam. (B. & F. 1434 !).

### STATICE Tourn. ex L.

130 species.—Cosmopolitan, chiefly in steppes and salt marshes.

**Statice axillaris** Forsk. Fl. Aeg.-Arab. 58.
*Locality*: *S.W.*: Wana, in rock-crevices on hills (F. 3425 !).
*Distribution*: Baluchistan, Arabia, Egypt.

**Statice cabulica** Boiss. in DC. Prodr. xii, 666; Fl. Or. v, 871.
*Locality*: *N.W.*: Boya (F. 4258 !).
*Distribution*: Punjab, 2,000-4,000 ft., Afghanistan.

**Statice macrorrhabdos** Boiss. Diagn. ser. 2, iv, 67.
*Vernacular name*: Garbeta (Waziri).
*Locality*: *N.W.*: 2 miles above Dossali Fort, hills on right bank of Khunai River, 5,150 ft. (B. & F. 1142 !).—Boya, stony plain (F. 422 ! 928 !).
*S.W.*: Barwand, 4,000 ft. (Duthie's Collect. 15635 !).
*Flowers*: 27-3-27 (Boya); 12-4-30 (Dossali); 29-4-1895 (Barwand).
*Distribution*: Baluchistan, Afghanistan.

**Statice Griffithii** Aitch. & Hemsley in Journ. Linn. Soc. xviii, 175, pl. xxiii, f. 1-4.
*Locality*: *N.W.*: E. of Spinwam Fort, stony nala, 2,650 ft. (B. & F. 666 !).—N. of Dossali Fort, stony plain (B. & F. 1005 ! 1005a !).—Spinwam, on hill (B. & F. 448 !).—E. of Miram Shah, hills (F. 1386 !).
*Distribution*: Kuram Valley, Jhelum Valley, 3,000 ft.

**Statice sp.**
*Locality*: *S.W.*: In the upper regions (Stewart).

### *ARMERIA L.

60 species.—N. temperate and Andine.

***Armeria vulgaris** Willd. Enum. Hort. Berol. 333.—*A. maritima* Willd. l.c.
*Vernacular name*: Common Thrift or Sea Pink.
*Locality*: *S.W.*: Razmak, in garden (B. & F.).
*Flowers*: April.
*Distribution*: Europe and America, along the seacoast.

## PRIMULACEAE.

550 species.—Cosmopolitan, but especially N. temperate.

### PRIMULA L.

220 species.—N. hemisphere, chiefly in hilly districts.

**Primula denticulata** Sm. Exot. Bot. ii (1805) 109, t. 114.

*Locality*: *S.W.*: Sirdar near Razmak, below Shuidar (Dundas 64 !).
*Flowers*: 20-3-30 (Sirdar).
*Distribution*: Temperate Himalaya, from Kashmir to Bhutan, 7,000-13,000 ft., Khasia Hills, 5,000 ft., Afghanistan.

**Primula adenophora** Blatter *sp. nov.* [*Primulacea pertinens ad sectionem capitatarum Pax similis est Primulae denticulate Smith sed differt foliis cum floribus nascentibus, foliis spathulatis, scapo glanduloso-pubescenti, bracteis ovato-triangularibus brevioribus pedicellis flavo-farinosis et glandulosis corollae tubo multo breviore.*]

*Herba ad 10 cm. alta. Folia cum floribus coatanea 9 cm. longa 2 cm. lata spathulata obtusa vel subacuta argute denticulata in petiolum latum alatum a lamina non discretum sensim attenuata nervis validis prominentibus stramineis infra parcissime farinosa et parce speciatim secus nervos pubescentia supra sparsim pubescentia. Scapus validus rigidus folia superans 8.5 cm. longus et 2 mm. diametiens capitulum multiflorum densissimum gerenus, brevissime glanduloso-pubescens speciatim in parte superiore, versus apicem dense albofarinosus et squamis stellatis cooperatus. Bracteae ovato-triangulares apice obtusae ad 5 mm. longae et 3 mm. latae ad basin, parcissime farinosae, margine et dorso glandulis brevissimis parce ornatae. Pedicelli 1-5 mm. longi, dense flavo-farinosi, brevissime glandulosi. Calyx 8 mm. longus tubuloso-campanulatus; segmenta tubo-aequilonga anguste lanceolata subacuta viridinigrescentia, marginae parce glandulosa. Corolla parce glandulosa, tubus 10 mm. longus extus flavus, limbus lilacinus fauce flavus 13 mm. diametiens, lobi obcordati profunde emarginati. Ovarium globosum. Stylus cum stigmate filamentis subbrevior. Filamenta antheris multo longiora. Fructum non vidi.*

A herb up to 10 cm. high. Leaves appearing with the flowers, 9 cm. long 2 cm. broad, spathulate, obtuse or subacute, sharply denticulate, narrowed slowly into a winged broad petiole, with strong broad prominent straw-coloured nerves, on the back very sparingly farinose and sparingly pubescent especially along the nerves, on the ventral side slightly pubescent. Scape stout, rigid, longer than the leaves, 8.5 cm. long and 2 mm. diam., carrying a big, dense, many-flowered head, glandular-pubescent especially in the upper part, towards the apex densely white-farinose and sparingly covered with stellate scales. Bracts ovate-triangular, obtuse, up to 5 mm. long and 3 mm. broad at the base, very sparingly farinose, on the margin and back with a very few short glands. Pedicels 1-5 mm. long, densely farinose, with short glandular hairs. Calyx 8 mm. long, tubular-campanulate; segments as long as the tube, narrowly lanceolate, subacute, green blackish, sparingly glandular on the margin. Corolla sparingly glandular; tube 10 mm. long, outside yellow; limb lilac, throat with a yellow rim, 13 mm. diam.; lobes obcordate, deeply emarginate. Ovary globose; style with stigma slightly shorter than the filaments. Filaments much longer than the anthers. Fruit not seen.

*Locality*: *S.W.*: Razmak, 7,000 ft., shady gulleys on damp rocks (D. G. Lowndes L4 ! type, L4a ! cotype).
*Flowers*: February to March 1932.
*Uses*: Bulbs edible according to local information (Lowndes).

**Primula Schlagintweitiana** Pax in Engl. Pflanzenr. iv, 237 (1905) 91.
*Locality*: *S.W.*: On moist rocks E. of Razmak Camp (B. & F. 1953 !).
*Flowers*: 28-4-30 (Razmak).
*Distribution*: W. Himalaya, Kashmir, Kumaon, up to 13,000 ft.

**Primula erosa** Wall. Cat. (1828) 611.
*Locality*: *S.W.*: N. of Razmak, below Springs, 7,700 ft. (B. & F. 1815 ! 1816 ! 1817 !).
*Flowers*: 25-4-30 (Razmak).
*Distribution*: W. Himalaya.

**Primula sp.**
*Locality*: *S.W.*: (Duthie's Collect. 15602 !).

### ANDROSACE (Tourn.) L.

84 species.—N. temperate (tufted xerophytes).

**Androsace rotundifolia** Hardw. in Asiat. Res. vi (1799) 350.

*Locality*: *S.W.*: Kaniguram, 6,500 ft. (Duthie's Collect. 15772 !).
*Flowers*: 13-5-95 (Kaniguram).
*Distribution*: Temperate Himalaya, 5,000-11,000 ft., from Kashmir to Kumaon.

**Androsace rotundifolia var. pusilla** Kunth in Engl. Pflanzenr. iv, 237 (1905) 178.
*Locality*: *N.W.*: Razmak Narai, 7,250 ft. (B. & F. 1218 ! 1221 !).
*S.W.*: E. of Razmak, on hill, 6,800 ft. (F. 3103 ! 3106 !), on grassy ground (B. & F. 1946 !).
*Flowers & Fruit*: 14-4-30 (Razmak Narai); 24-4-30, 5-5-27 (Razmak).
*Distribution*: W. Himalaya, Afghanistan.

**Androsace rotundifolia** Hardw. **var. incisa** Kunth in Engl. Pflanzenr. iv, 237 (1905) 177.—*A. incisa* Wall. in Roxb. Fl. Ind. ed. Carey (1824) 16.
*Locality*: *S.W.*: Near Kaniguram brook (Stewart).
*Distribution of var.*: W. Himalaya, from Kashmir, Hazara, Afghanistan.

### ANAGALLIS (Tourn.) L.

25 species.—Europe, Asia, Africa, S. America.

**Anagallis arvensis** L. Sp. Pl. (1753) 148.
*Locality*: *S.W.*: Barwand, 4,000 ft., on level stony plain (Duthie's Collect. 15714 !).
*Flowers*: 26-4-1895 (Barwand).
*Distribution*: More or less throughout India, Europe, W. Asia and introduced into most temperate regions.

**Anagallis arvensis var. latifolia** Lange Pug. (1865) 221.
*Locality*: *N.W.*: Near Chasmai River, 3 miles from Miram Shah, in cultivated field, 3,150 ft. (B. & F. 325 !).
*Flowers & Fruit*: 24-3-30 (Chasmai River).
*Distribution*: S. and N.W. Mediterranean, eastwards to Persia.

### SAMOLUS (Tourn.) L.

10 species.—Cosmopolitan, especially S. hemisphere.

**Samolus Valerandi** L. Sp. Pl. (1753) 243.
*Vernacular name*: Aukovanna, Aparyara.
*Locality*: *N.W.*: Dwa Warkha (Stewart).
*S.W.*: Pre Ghal (J. Williams 7867 !).
*Tank*: (J. Williams !).
*Flowers*: 1-5-1891 (Tank).
*Fruit*: 1-8-1888 (Pre Ghal).
*Distribution*: Baluchistan, Afghanistan, Persia, Persian Baluchistan. Most temperate regions.

## SAPOTACEAE.

600 species.—Tropics.

### MONOTHECA A. DC.

(*Reptonia* A. DC.).

1 species.—From India to Muscat.

**Monotheca buxifolia** Dcne. *ex observ. facta a cl. Boissiero sub descript. generis Reptoniae in sua Fl. Or.* iv (1879) 32.—*Reptonia buxifolia* A. DC. in DC. Prodr. viii (1844) 153.
*Quoad Monothecam Mascatensem* A. DC. *vide quod Boissierus l.c.* 33 *observat*: *Reptonia buxifolia Monothecam Mascatensem omnino refert et ab ea ex cl. Decaisne specifice non differt. Hac ratione inductus tamquam synonymum subjungo*: *Monotheca Mascatensis* A. DC. in DC. Prodr. viii, 152.
*Vernacular name*: Gurgura (Pu., Waziri).
*Locality*: *N.W.*: N.-E. of Razmak, Siroba (Stewart).—Above Dossali, 5,050 ft. (B. & F. 1097 ! 1101 !).—Razani (F. 2974 !).—W. of Miram Shah Fort, stony plain and hillside, 3,150-3,200 ft. (B. & F. 11 !).—Hills E. of

Miram Shah Fort (B. & F. 530 !).—Datta Khel (F. 1238 ! 1240 !).—Boya (F. 1461 !).

*S.W.*: Sararogha (F. 149 ! 221 !).—Above Palosina (Stewart).—Near Anai above Palosina (Stewart).—Barwand, 4,000 ft. (Duthie's Collect. 15717 !).—Jandola (F. 263 !).—Wana, on hills (F. 3882 !).—Sarwekai (F. 3703 !).—Dargai (F. 3720 !).

*Tank*: (J. Williams !).

*Flowers*: 29-3-30 (Miram Shah); 12-4-30 (Dossali); 26-4-1895, May (Barwand); 22-6-27 (Sarwekai).

*Fruit*: 26-4-1895 (Barwand); 25-5-27 (Jandola).

*Distribution*: Punjab, Baluchistan, Afghanistan, Muscat in Arabia.

*Uses*: Fruit eaten.

## OLEACEAE.

400 species.—Tropical and warm temperate regions, especially E. Indies.

### JASMINUM (Tourn.) L.

170 species.—Tropics and subtropics.

**Jasminum humile** L. Sp. Pl. (1753) 7.—*J. revolutum* Sims in Bot. Mag. t. 1731.

*Vernacular name*: Gadanghgava (Waziri).

*Locality*: *S.W.*: Near Kaniguram, about 6,500 ft., occasional (Stewart).—Pre Ghal (Duthie's Collect. 15621 !).—Hill E. of Razmak, 6,800 ft. (B. & F. 1881 ! 1891 !).

*Flowers*: May, 15-5-1895 (Pre Ghal).

*Distribution*: Himalaya, 4,000-10,000 ft., to Nepal, Bhutan, S. India, Ceylon, Salt Range, Baluchistan, Afghanistan.

**Jasminum officinale** L. Sp. Pl. (1753) 7.

*Vernacular name*: Shung (Waziri).

*Locality*: *S.W.*: Near Kaniguram, about 8,200 ft., (Stewart).—Hill E. of Razmak, 6,800 ft. (B. & F. 1892 !).

*Flowers*: May.

*Distribution*: Himalaya, 3,000-9,000 ft., Trans-Indus.

**Jasminum grandiflorum** L. Sp. Pl. ed. 2 (1762) 9.

*Locality*: *N.W.*: Miram Shah (F. 3370 !).

*S.W.*: Sur Duar Hills (Dundas 737a !).—Razmak, 6,300 ft. (F. 1761 ! 1810 ! 1821 !, B. & F. 1879 !).

*Flowers*: 27-6-30 (Sur Dar Hills).

**Jasminum sp.**

*Locality*: *N.W.*: Miram Shah (B. & F. !).

### SYRINGA L.

10 species.—Europe, Asia.

**Syringa persica** L. Sp. Pl. 9; Boiss. Fl. Or. iv (1879) 38; Stewart Punj. Pl. (1869) 141; Aitchis. Fl. Kuram Valley (1880) 78; Brandis Ind. Trees (1911) 445.

*Locality*: *S.W.*: Razmak, on open stony ground, 6,500 ft. (F. 2377 ! 2390 ! 3019 !).—N. of Razmak, 7,700 ft. (B. & F. 1846 !).

*Flowers*: 25-4-30, 2-5-27 (Razmak).

*Distribution*: Persia, Caucasus.

**Syringa sp.**

*Locality*: *S.W.*: Upper regions (Stewart).

### FRAXINUS Tourn. ex L.

60 species.—N. hemisphere, especially N. America, E. Asia and Mediterranean.

**Fraxinus xanthoxyloides** Wall. Cat. (1828) 2833.

*Vernacular name*: Shung (Waziri).

*Locality*: *S.W.*: Kaniguram (Stewart).—Razmak (F. 3328 ! 3330 !).

*Distribution*: N.-W. Himalaya 3,000-9,000 ft., Baluchistan, Afghanistan, Trans-Indus.

**Fraxinus sogdiana** Bunge Pl. Lehm. 390; Boiss. Fl. Or. iv, 41.—*F. oxycarpa var. sogdiana* Wenzig. in Engler's Bot. Jahrb. iv (1883) 176.
*Vernacular name*: Shineae (Waziri).
*Locality*: *N.W.*: Above Dossali Fort, bed of Khunai River, 5,000 ft. (B. & F. 1140 ! 1141 !).—N. of Dossali Fort, in nala called Rosh, 4,900 ft. (B. & F. 1016 !).
*Flowers*: 12-4-30 (Dossali).
*Distribution*: Turkestan.

**Fraxinus potamophila** Herd. in Regel & Herder Enum. pl. Semen. no. 698.—*F. Regelii* Dippel Laubhozk. i (1889) 97.
*Vernacular name*: Shung (Waziri).
*Locality*: *S.W.*: Razmak (F. 2035 !).
*Distribution*: Lycia, Armenia, Persia, Turkestan.

OLEA (Tourn.) L.

35 species.—Mediterranean, Africa, Indo-Malaya, Australia, New Zealand, Polynesia.

**Olea cuspidata** Wall. Cat. (1828) no. 2817.—*O. europaea* L. *var. cuspidata* Wall.; Stewart Punj. Pl. (1869) 139.
*Vernacular name*: Shwavan (Waziri), Kau.
*Locality*: *N.W.*: Razani, common, 5,000 ft. (F. 2157 ! 2838 !, B. & F. 68 !).—Boya (F. 1060 !).—Miram Shah (F. 800 ! 1453 !).—W. of Spinwam Fort, on Chota Darweshta, 3,000-4,800 ft. (B. & F. 744 !).—N. of Dossali Fort, stony plain, 4,900 ft. (B. & F. 1000 !).
*S.W.*: Wana, on hills N.-E. of Fort, 4,500 ft. (F. 3407 ! 3415 ! 3427 ! 3884 !).—Sarwekai, on hills, about 3,600 ft. (F. 3985 ! 3986 ! 3991 ! 4010 !).—Razmak, common on the hill ranges, about 6,800 ft. (F. 3105 ! 3338 ! 3340 ! 3349 !).—Sararogha (F. 42 ! 49 !).
*Tank*: Sheikh Badin near Tank (J. Williams 7868 !).
*Flowers*: 18-5-27, June (Sararogha).
*Distribution*: N.-W. India, Punjab, Nepal, Sind, Baluchistan, Afghanistan.

**Olea europaea** L. Sp. Pl. 8.
*Vernacular name*: Khwan (Pu.).
*Locality*: *N.W.*: Razani (Stewart), Siroba (Stewart).
*S.W.*: Above Palosina common on the lower hills (Stewart).—Near Anai above Palosina (Stewart).—N. of Doboi, about 5,000 ft., on a feeder of the Zam (Stewart).—Wide shingle plateau of Tandachina (Stewart).
*Distribution*: Mediterranean, Nubia, Orient.

## SALVADORACEAE.

8 species.—Asia, Africa.

SALVADORA Garcin ex L.

2 species.—W. Asia, Africa.

**Salvadora oleoides** Dcne. in Jacq. Voy. Bot. (1844) 140, t. 144.
*Vernacular name*: Plewan (Pu.); Pilu (Hind.); Jal.
*Locality*: *S.W.*: Above Khirgi (Stewart).—Jandola (F. 4097 !).
*Tank*: (Stewart, J. Williams 7170 !), common in many places along the frontier (Stewart).
*Flowers*: April 1860, 4-5-1888 (Tank).
*Distribution*: Punjab, Sind, Baluchistan, Arabia.
*Uses*: 'Its fruit is held by the inhabitants to be a great provocative of sexual crimes, but the chances are that its supposed effects arise less from any aphrodisiac qualities than from the opportunities afforded when parties of both sexes go out from the villages to gather the ripe fruit.' (Stewart).—Leaves used in dyspepsia. Fruit eaten (Williams).

## APOCYNACEAE.

1,400 species.—Mostly tropical, a few temperate.

### RHAZYA Dcne.

2 species.—W. Asia.

**Rhazya stricta** Dcne. in Ann. Nat. Sc. ser. 2, iv, 81.
*Vernacular name*: Ganderai (Waziri).
*Locality*: *N.W.*: In the lower regions (Stewart).—Stony ground at foot of nearest hill E. of Spinwam Fort, 2,600 ft. (B. & F. 447 ! 652 ! 757 !).
*Flowers*: 1-4-30, 3-4-30 (Spinwam).
*Fruit*: 1-4-30 (Spinwam).
*Distribution*: Punjab, Salt Range, Sind, Baluchistan, Afghanistan, Arabia.

### *VINCA L.

5 species.—Europe, W. Asia.

***Vinca minor** L. **var. atropurpurea compacta** Hort.
*Vernacular name*: Common Periwinkle.
*Locality*: *N.W.*: Miram Shah, 3,100 ft. (B. & F. 523 !).
*Flowers*: 28-3-30 (Miram Shah).
*Distribution*: Europe.

### NERIUM L.

3 species.—Mediterranean to Japan.

**Nerium odorum** Soland in Hort. Kew. ed. 1, i (1789) 297.
*Vernacular name*: Ganderai (Mashudi).
*Locality*: *N.W.*: Shakai, 6,000-7,000 ft. (Duthie's Collect. 15654 !).—Razani (F. 2055 ! 2057 !).
*S.W.*: Between Sararogha and Razmak, Marabi torrent bed (F. 1531 ! 1533 ! 1534 ! 1539 !).
*Flowers*: 30-4-1895 (Shakai); 24-6-27 (Marabi).
*Distribution*: Himalaya up to 5,000 ft., Punjab, Salt Range, Trans-Indus, Baluchistan, Afghanistan, Persia.

## ASCLEPIADACEAE.

1,700 species.—Mostly tropics, especially Africa, but a few temperate.

### HEMIDESMUS R. Br.

1 species.—India.

**Hemidesmus indicus** R. Br. in Mem. Wern. Soc. i (1811) 57.
*Locality*: *N.W.*: W. of Spinwam Fort, Chota Darweshta, 2,750-3,000 ft. (B. & F. 714 !).
*Distribution*: N. Provinces of India, Abu, Ceylon.

### PERIPLOCA Tourn. ex L.

12 species.—Temperate regions of Old World, tropical Africa.

**Periploca aphylla** Dcne. in Jacq. Voy. Bot. (1844) 109, t. 116.
*Vernacular name*: Barrarra (Pu.), Baradha (Waziri), Barad (Bettani tribe).
*Locality*: *N.W.*: Miram Shah, on hills and plain, 3,600 ft. and upwards (B. & F. 13 ! 553 !).—Chota Darweshta, on boulder-strewn slopes, 3,000-4,800 ft. (B. & F. 741 !).—Dariawasti, near Datta Khel (B. & F. 1643 !).—Near Shewa Post, left bank of Volam River, very common (B. & F. 893 !).—Datta Khel (F. 1329 ! 1339 !).—Boya (F. 557 ! 568 ! 899 !).—Razani, rare (F. 2083 !, Stewart).
*S.W.*: Near Palosina, common (Stewart).—Barwand (Duthie's Collect. 15715 !).—Sararogha (F. 155 ! 605 ! 621 !).—Jandola (F. 267 ! 4105 !).—Sarwekai, common (F. 3989 !).—Dargai Post (F. 3718 ! 3719 !).—Tenai Post (F. 3791 !).—Spin (F. 3826 !).—Wana (F. 3409 ! 3871 !).

*Flowers*: 29-3-30 (Miram Shah); 2-4-30 (Chota Darweshta); 5-4-30 (Shewa Post); 8-4-27 (Boya); 19-4-30 (Dariawasti); 26-4-1895 (Barwand); 18-6-27 (Wana).
*Fruit*: 22-6-27 (Dargai).
*Distribution*: Punjab, Sind, Baluchistan, Afghanistan, Persia, Arabia, Nubia.
*Uses*: Tender shoots eaten by donkeys and goats. Used to increase flow of milk in cattle.

### GLOSSONEMA Dcne.

6 species.—Tropical Africa and Asia.

**Glossonema varians** Benth. in Benth. & Hook. f. Gen. Pl. ii (1876) 748.
*Vernacular name*: Mangartevna (Waziri).
*Locality*: *N.W.*: 2 miles above Dossali Fort, bed of Khunai River, 5,050 ft. (B. & F. 1137 !).—Razani (F. 2948 ! 2959 !).—Razmak Narai, stony slope of ravine, 6,650 ft. (B. & F. 1225 ! 1257 !).
*S.W.*: Razmak, small plants scattered all over (F. 2361 !).—N. of Razmak towards Springs, 6,750-7,300 ft. (B. & F. 1760 ! 1941 ! 1949 !).
*Flowers*: 12-4-30 (Dossali); 14-4-30 (Razmak Narai); 5-5-27 (Razmak).
*Fruit*: Fruit of previous year still found on 5-5-27 at Razmak.
*Distribution*: Sind, Baluchistan, Persia.

### CALOTROPIS R. Br.

3 species.—Tropical Asia, Africa.

**Calotropis procera** R. Br. in Ait. Hort. Kew. ed. 2, ii, 78.
*Vernacular name*: Spulmei, Spelmei (Pu., Waziri).
*Locality*: *N.W.*: Miram Shah, on stony plain (F. 471 ! 882 !).—Dwa Warkha (Stewart).
*S.W.*: Zam Valley above Khirgi N.-W. of Tank, frequent in the shingly bed of river (Stewart).—Sararogha (F. 39 ! 48 !).—Jandola, open stony ground and nalas (F. 653 !).—Sarwekai (F. 3917 !).—Dargai Post (F. 3732 !).—Spin, scattered all over stony plain (F. 3841 !).
*Flowers*: 16-4-27 (Miram Shah); 18-5-27 (Sararogha); 24-5-27 (Jandola); 21-6-27 (Spin).
*Distribution*: Hot and drier parts of India, from the Punjab and Sind to W. and Central India, Baluchistan, Afghanistan, Persia, Arabia to Egypt and tropical Africa.

### PENTATROPIS R. Br.

8 species.—Palaeotropics.

**Pentatropis spiralis** Dcne. in Ann. Sc. Nat. ser. 2, ix (1838) 327, t. 11.—*P. cynanchoides* R. Br. in Salt Voy. Abyss. (1814) App. p. 64.
*Locality*: *N.W.*: E. of Spinwam, stony sandy nala, 2,650 ft. (B. & F. 676 !).
*Distribution*: Punjab, Baluchistan, Afghanistan, Arabia, tropical Africa.

**Pentatropis microphylla** W. & A. in Wight Contrib. (1834) 52.
*Locality*: *N.W.*: In the lower regions (Stewart).
*Distribution*: India, Ceylon.

### VINCETOXICUM Rupp.

40 species.—Warm countries.

**Vincetoxicum officinale** Mönch Meth. (1794) 317.—*Cynanchum vincetoxicum* (L.) R. Br. in Mém. Wern. Soc. i, 47.—*Asclepias Vincetoxicum* L. Sp. Pl. (1753) 216.
*Locality*: *S.W.*: Kaniguram (Duthie's Collect. 15766 !).
*Flowers*: 13-5-1895 (Kaniguram).
*Distribution*: Temperate Himalaya, Kashmir to Sikkim, 7,000-11,000 ft., westwards to Europe.

### GYMNEMA R. Br.

40 species.—W. Africa to Australia.

**Gymnema sylvestre** R. Br. in Mém. Wern. Soc. i (1811) 33.
*Locality*: *S.W.*: E. of Razmak, on hill, 6,800 ft. (B. & F. 1886 !).
*Flowers*: 26-4-30 (Razmak).
*Distribution*: W. India, Ceylon, tropical Africa.

### LEPTADENIA R. Br.

15 species.—Tropical Africa, Asia.

**Leptadenia pyrotechnica** (Forsk.) Dcne. in Ann. Sc. Nat. (1838) 269.—*L. spartium* Wight Contrib. (1834) 48.
*Vernacular name*: Movung (Waziri).
*Locality*: *N.W.*: Boya (F. 1427 ! 1440 !).—Miram Shah (F. 1401 !).—E. of Spinwam Fort, sandstone ridge, 2,800 ft. (B. & F. 800 !).
*Flowers*: 27-3-27 (Boya); 14-4-27 (Miram Shah).
*Distribution*: Punjab, Rajputana Desert, Baluchistan, Arabia, Egypt, tropical Africa.
*Uses*: Plant is dried and burnt and ground and mixed with tobacco, and used as intoxicant (F.).

### ORTHANTHERA Wight.

4 species.—Africa, India.

**Orthanthera viminea** Wight Contrib. (1834) 48.
*Vernacular name*: Movung (Waziri).
*Locality*: *N.W.*: Razani (Stewart).—Boya (F. 1501 ! 1503 !).
*Flowers*: 8-4-27 (Boya).
*Distribution*: N.-W. India along the base of the Himalaya, 1,000-3,000 ft., from Peshawar to Oudh (See Parker, p. 353).

### CARALLUMA R. Br.

60 species.—Mediterranean to East Indies.

**Caralluma** (*Boucerosia*) **tuberculata** N. E. Brown in Kew Bull. (1895) 264; Gravely & Mayuran. in Bull. Madras Govern. Museum, new series iv, pt. 1 (1931) 20.—*Boucerosia aucheriana* Hook. f. Fl. Brit. Ind. iv (1885) 78 (*non* Decaisne).
*Vernacular name*: Pavona (Waziri); Pamanai (Bettani tribe).
*Locality*: *N.W.*: Chota Darweshta, in the shade of boulders, 2,750-3,000 ft. (B. & F. 707 !).—Miram Shah, 3,100 ft. (B. & F. 6 !, F. 379 ! 4209 !).—Boya (F. 279 ! 1064 !)
*S.W.*: Palosina (Stewart).—Jandola (F. 239 !).—Wana (F. 3873 !).
*Fruit*: 2-4-30 (Chota Darweshta); 14-4-27 (Miram Shah).
*Distribution*: W. Punjab, Salt Range, Baluchistan, Afghanistan.
*Uses*: The leafless stems are intensely bitter and are regarded as stomachic by both Pathans and Punjabis (Stewart).
*Note*: Its Persian name, Panj-angusht (five fingers), is descriptive of its appearance (Stewart).

## LOGANIACEAE.

550 species.—Tropics, a few warm temperate.

### BUDDLEJA Houst.

90 species.—Tropics and subtropics.

**Buddleja crispa** Benth. Scroph. Ind. (1835) 43; Wall. Cat. 6404, Marquand in Kew Bull. (1930) 199.
*Vernacular name*: Khadvanai (Waziri).
*Locality*: *N.W.*: Shakai (Duthie's Collect. 15686 !).—Dossali, nala (B. & F. !).

*S.W.*: Kaniguram, about 6,500 ft., frequent, also at 8,200 ft. (Stewart).—N.-E. of Razmak, common (Stewart).—N. of Razmak, 6,700-7,300 ft. (B. & F. 1751 ! 1872 !).—E. of Razmak, on hill (B. & F. 1947 !).

*Flowers*: April 1860 (Kaniguram, Razmak); 25-4-30 (Razmak); 30-4-1895 (Shakai).

*Distribution*: N.-W. Himalaya, Baluchistan, Afghanistan, Kuram Valley, Bhutan.

**Buddleja crispa** Benth. **var. ferruginea** Blatter *var. nov.* [*Ramuli, foliorum facies inferior et inflorescentia ferrugineo-tomentosa, facies foliorum superior cinereo-tomentosa.*]

*Vernacular name*: Speravona, Speravonie (Waziri).

*Locality*: *N.W.*: Razani (F. 2849 ! 2888 !).

*S.W.*: N. of Razmak, below Springs, 7,700 ft. (B. & F. 1876 !, F. 2565 ! 2801 ! 2815 !).—Razmak (F. 3132 !).

*In bud*: 25-4-30 (Razmak).

*Flowers*: 5-5-27 (Razmak).

*Distribution*: Waziristan.

## GENTIANACEAE.

800 species.—Cosmopolitan.

### Gentiana Tourn. ex L.

400 species.—Cosmopolitan, Africa excepted, chiefly alpine.

**Gentiana Kaufmanniana** Regel *et* Schmalh. in Acta Hort. Petrop. vi (1879), 331.

*Locality*: *S.W.*: Pre Ghal (J. Williams 7873 !).

*Flowers*: 8-8-1888 (Pre Ghal).

*Distribution*: Turkestan.

*Uses*: Used for bronchitis (Williams).

**Gentiana Moorcroftiana** Wall. Cat. 4390.

*Locality*: *S.W.*: Pre Ghal (Hay).

*Flowers*: September (Pre Ghal).

*Distribution*: W. Himalaya, 8,000-12,000 ft.

**Gentiana Lowndesii** Blatter in Journ. Bomb. Nat. Hist. Soc. xxxv (1932), 861.

*Locality*: *N.W.*: Alexandra Ridge, 7,800 ft. (Capt. D. G. Lowndes 2430 !).—Plentiful on open hill-tops, 7,500-8,500 ft.

*Flowers*: October 1931.

### Swertia L.

90 species.—Cosmopolitan, except Africa.

**Swertia cordata** Wall. Cat. 4378.

*Locality*: *S.W.*: Pre Ghal (Hay).

*Distribution*: Temperate Himalaya, 4,000-12,000 ft. from Kashmir to Bhutan, abundant westwards, Khasia Mts. 3,000-5,000 ft.

## CONVOLVULACEAE.

1,000 species.—Tropical and temperate regions.

### Convolvulus (Tourn.) L.

180 species.—Temperate, a few tropical regions.

**Convolvulus arvensis** L. Sp. Pl. 153.

*Vernacular name*: Parvatiae (Waziri).

*Locality*: *N.W.*: Dwa Warkha (Stewart).—Datta Khel Fort, garden 4,600 ft. (B. & F. 1415 !).—Datta Khel village (B. & F. 1443 !).—Boya (F. 1015 ! 1033 ! 1159 !).—Miram Shah village (B. & F. 459 !, F. 293 !).—Razani (F. 2919 !).

*S.W.*: Kaniguram (Stewart, Duthie's Collect. 15752 !).—N. of Razmak, below Springs (B. & F. 1874 !, F. 1895 ! 1966 !).—Sararogha (F. 28 !).—Dargai Post (F. 3753 ! 3773 !).

*Flowers*: 28-3-30 (Miram Shah village); 5-4-27 (Boya); 16-4-27 (Miram Shah village); 17-4-30 (Datta Khel); 25-4-30 (Razmak); 30-4-27 (Razmak); 6-5-27 (Razmak); 18-5-27 (Sararogha).

*Distribution*: Nearly all temperate and subtropical regions.

**Convolvulus pluricaulis** Chois. Convolv. Or. 95.

*Locality*: *S.W.*: Near Palosina (Stewart).

*Tank*: ( Stewart).

*Flowers*: April 1860 (Tank, Palosina).

*Distribution*: Punjab Plain, Upper Gangetic Plain to Bihar and Chota Nagpur, Gujarat, Senegal.

*Uses*: Considered by the Punjabis as a 'cooling' vegetable (Stewart).

**Convolvulus leiocalycinus** Boiss. Diagn. ser. 1, vii, 28; Fl. Or. iv, 86.

*Locality*: *Tank*: Shaur Hill near Tank (J. Williams !).

*Flowers*: 25-3-1891 (Tank).

*Distribution*: Baluchistan, Persia.

**Convolvulus lineatus** L. Syst. ed. 10, 923; Led. Fl. Ross. iii, 90; Boiss. Fl. Or. iv, 98.

*Locality*: *S.W.*: Wana, 4,500 ft. (Duthie's Collect. 15671 !).

*Flowers*: 6-5-1895 (Wana).

*Distribution*: Baluchistan, Afghanistan, Orient, Asia Minor, Europe, N. Africa, Soongaria, Altai.

**Convolvulus Aitchisonii** C. B. Clarke in Journ. Linn. Soc. xix (1882) 179.

*Locality*: *N.W.*: N. of Dossali Fort, stony plain, 4,900 ft. (B. & F. 1010 ! 1079 ! 1263 ! 1264 !).—Rare.

*Flowers*: 15-4-30.

*Distribution*: Afghanistan.

**Convolvulus erinaceus** Ledeb. in Eichw. Casp.—Cauc. p. 3-11, t. 7.—*Convolvulus spinosus* Burm. Fl. Ind. 47, t. 19, fig. 4 (*non* Descr. *nec* Eichw.); Boiss. Fl. Or. iv, 87.

*Locality*: *S.W.*: (Duthie's Collect. 15740 !).

*Distribution*: Baluchistan, Afghanistan, Persia, Turkestan.

**Convolvulus acanthocladus** Boiss. Diagn. ser. 1, vii, 27.

*Vernacular name*: Khauckzie (Mashudi).

*Locality*: *S.W.*: Sarwekai, stony ground (F. 4458 !).

*Fruit*: 7-6-27 (Sarwekai).

*Distribution*: Persia.

**Convolvulus rottlerianus** Choisy Convolv. Orient. in Mém. Soc. Phys. Genève vi (1834) 477.

*Locality*: *S.W.*: Jandola (F. 4109 !).

*Flowers & Fruit*: 29-5-27 (Jandola).

*Distribution*: Deccan, Rajputana Desert, Baluchistan, Afghanistan.

**Convolvulus pilosellaefolius** Descr. in Lam. Encycl. iii, 551; Boiss. Fl. Or. iv, 103.

*Locality*: *N.W.*: Datta Khel, in a garden, 4,600 ft. (B. & F. 1405 !).

*Distribution*: Afghanistan, Persia, Mesopotamia.

**Convolvulus microphyllus** Sieb. ex Spreng. Syst. i (1825) 611.

*Locality*: *S.W.*: Dargai Post (F. 3771 !).

*Distribution*: Gujarat, Rajputana Desert, Sind, Baluchistan to Egypt and Nubia.

### EVOLVULUS L.

90 species.—Tropics and subtropics.

**Evolvulus alsinoides** L. Sp. Pl. (1762) 392.

*Locality*: *N.W.*: 9 miles S. of Spinwam (B. & F. 694 !).

*S.W.*: Jandola, stony ground (F. 3892 ).

*Flowers & Fruit*: 1-4-30 (Spinwam); 3-6-27 (Jandola).

*Distribution*: Tropical and subtropical countries.

### CRESSA L.

5 species.—Tropics and subtropics.

**Cressa cretica** L. Sp. Pl. (1753) 223.
*Locality*: *S.W.*: Shalkh (J. Williams 7180 !).—Wana (F. 3501 !).
*Distribution*: All warm regions.

## SOLANACEAE.

1,500 species.—Tropical and temperate regions; chief centre Central and S. America.

### SOLANUM (Tourn.) L.

1,225 species.—Tropical and temperate regions.

**Solanum nigrum** L. Sp. Pl. (1753) 186.
*Locality*: *N.W.*: N. of Miram Shah village, clay bank of irrigation channel, 3,150 ft. (B. & F. 454 !).—Hills east of Miram Shah Fort (B. & F. 555 !).—Near Miram Shah Fort, bank of Chasmai River, sandy clay (B. & F. 211 !).
*Tank*: (Stewart, J. Williams 7180 !).
*Flowers*: 28-3-30 (Miram Shah); April 1860 (Tank); 4-5-1888 (Tank).
*Distribution*: All temperate and tropical regions of the world.

**Solanum gracilipes** Dcne. in Jacquem. Voy. Bot. 113, t. 119.
*Locality*: *N.W.*: Lower regions (Stewart).—W. of Spinwam Fort, boulder slope of Chota Darweshta, 2,650-3,000 ft. (B. & F. 696 ! 706 ! 743 !).
*Flowers*: 2-4-30 (Spinwam).
*Distribution*: Kuram Valley, Baluchistan, Punjab, Sind.

**Solanum xanthocarpum** Schrad. & Wendl. Sert. i (1795) 8, t. 2.
*Vernacular name*: Kolkondai, Madaginiae (Waziri).
*Locality*: *N.W.*: Razani (Stewart).—Boya, rare (F. 552 ! 1425 !).—Miram Shah, on stony ground, 3,000 ft. (F. 885 !).—Near Miram Shah Fort, bed of Chasmai River in gravel and sand (B. & F. 274 !).—Hills E. of Spinwam Fort, gravel (B. & F. 764 !).—Shewa Post, 2,100 ft. (B. & F. 869 !).
*S.W.*: Tenai, stony ground, not common (F. 4042).—Jandola, on dry banks of Tank River, 2,200 ft. (F. 779 ! 4108 ! 4418 !).—Sararogha, dry nala and dry stony slopes (F. 152 ! 608 !).—Spin, open stony plain (F. 354 !)—Sarwekai (F. 3921 ! 3950 !).
*Flowers*: April, May.
*Fruit*: April, May, June.
*Distribution*: Tropics of the Old World.

***Solanum tuberosum** L. Sp. Pl. 185.
*Vernacular name*: Potato.
*Locality*: *N.W.*: In the hills, above 5,000 ft. (B. & F.).
*Distribution*: Native of America.

### *LYCOPERSICUM Hill.

10 species.—South America.

***Lycopersicum esculentum** Mill. Gard. Dict. ed. 8 (1768) n. 2.
*Locality*: *N.W.*: Miram Shah Fort, cultivated (B. & F. !).
*Distribution*: Tropical America.

### WITHANIA Pauq.

5 species.—Palaeotropics, subtropics.

**Withania coagulans** Dunal in DC. Prodr. xiii, pt. 1, 685; Boiss. Fl. Or. iv (1879) 288.—*Puneeria coagulans* Stocks in Hook. Ic. t. 801; Wight Ic. 1616.
*Vernacular name*: Shapeanga (Waziri); Puniar called puniri or punir-bad (i.e. cheese herb) in Afghanistan.
*Locality*: *N.W.*: Miram Shah, open stony plain (F. 146 ! 431 ! 477 ! 510 ! 877 ! 879 ! 1450 !).—Boya, open stony plain, 4,000 ft. (F. 936 ! 1445 ! 1477 ! 1478 !), at foot of hill (F. 1444 !).—Datta Khel, open stony plain

(F. 1290 ! 1291 ! 1292 ! 1942 !).—Near Datta Khel village, 4,600 ft. (B. & F. 1476 !).

*S.W.*: Wana, 4,500 ft., in open stony plain (F. 3429 ! 3438 ! 3439 ! 3448 ! 3449 ! 3554 ! 3556 ! 3589 ! 3629 ! 3696 ! 3890 !), on hillside F. 3682 !).—Palosina (Stewart).—Spin, open stony plain (F. 3550 ! 3833 ! 3854 ! 3863 !).—Jandola, open stony plain and in nalas 2,300 ft. (F. 262 ! 623 ! 724 ! 4115 !).—Sarwekai (F. 3908 ! 3909 !).—Sararogha, stony plain (F. 126 !). —Barwand (J. Williams).

*Flowers*: March, April.

*Fruit*: May, June.—Once in March found old fruits and new flowers on same plant.

*Distribution*: Afghanistan, Baluchistan, Kuram Valley, Punjab, Sind, Sutlej Valley, 3,300 ft.

*Uses*: Used against stomach trouble.

**Withania somnifera** Dunal in DC. Prodr. xiii, i, 453; Boiss. Fl. Or. iv (1879) 287.—*Physalis somnifera* Forsk. Fl. Aegypt.—Arab. (1775) lxiii no. 130 cvi, no. 133.

*Locality*: *S.W.*: Jandola, on open stony plain, 2,200 ft. (F. 627 ! 634 ! 4122 !), along Tank River (F. 701 ! 4189 !).

*Flowers*: May.

*Fruit*: May.

*Distribution*: Mediterranean region, tropical and S. Africa, Arabia, Persia, Baluchistan, Kuram Valley, Sind, Punjab, other parts of India.

### DATURA L.

15 species.—Tropical and warm temperate regions.

**Datura Stramonium** L. Sp. Pl. (1753) 179.

*Vernacular name*: Barbak (Waziri).

*Locality*: *N.W.*: Miram Shah, nalas and banks (F. 380 !).

*S.W.*: On way to Razmak (Stewart).—N. of Razmak Camp, below Springs, 7,700 ft. (B. & F. 1845 !).

*Fruit* of previous year found 25-4-30.

*Distribution*: Cosmopolitan.

**Datura fastuosa** L. Syst. Nat. ed. 10 (1759) 932.

*Locality*: *N.W.*: E. of Miram Shah Fort, rocky bank of Chasmai River, 3,100 ft. (B. & F. 228 ! 233 !).

*S.W.*: Jandola in stony ground, 2,200 ft. (F. 725 ! 744 !).—Sararogha (F. 256 !).

*Flowers*: 23-3-30, May (Chasmai River).

*Distribution*: Cosmopolitan in the tropics.

**Datura alba** Nees in Trans. Linn. Soc. xvii, 73.—*D. fastuosa* L. *var. alba* C. B. Clarke in Hook. f. Fl. Brit. Ind. 4 (1883) 213.

*Locality*: *Tank*: (J. Williams 7883 !).

*Flowers*: 23-5-1888 (Tank).

*Distribution*: India to China and Malaya, Philippines.

**Datura Metel** L. Sp. Pl. (1753) 179.

*Locality*: *S.W.*: Sararogha, in sheltered spots in ravine, rare, 4,000 ft. (F. 50 !).

*Distribution*: Kashmir, N.-W. Himalaya, S. Europe. Supposed to have originally spread from S. America.

### PHYSOCHLAINA G. Don.

5 species.—Central Asia.

**Physochlaina praealta** Hook. f. Bot. Mag. t. 4600, *in nota*.

*Locality*: *S.W.*: In the lower regions (Stewart).

*Distribution*: N. Kashmir, W. Tibet, Kashgar, Yarkand.

### HYOSCYAMUS (Tourn.) L.

11 species.—N. Africa, Europe, Asia.

**Hyoscyamus niger** L. Sp. Pl. (1753) 179; Boiss. Fl. Or. iv (1879) 294.—*H. persicus* Boiss. & Buhse Enum. 158.

*Locality*: *S.W.*: N. of Razmak Camp in torrent bed, 6,500 ft. (F. 1592 ! 1633 ! 2278 ! 2279 !).—Razmak (Stewart).—Kaniguram, 6,500 ft. (Duthie's Collect. 15742 !).—Slopes of Shuidar, 7,000-9,000 ft. (F. 1588 ! 1589 !).
*Tank*: Near Tank, Shaur Hill (J. Williams !).
*Flowers & Fruit*: 18-4-30 (Shuidar); May.
*Distribution*: Europe, W. & N. Asia, Persia, Caucasus, Transcaucasus, temperate W. Himalaya, 8,000-11,000 ft., from Kashmir to Garhwal.

**Hyoscyamus muticus** L. Mant. 45.—*H. insanus* Stocks in Hook. Kew Journ. iv, 178.
*Locality*: *N.W.*: Khajuri Post, right bank of Sua Algad, on gravel, 2,250 ft. (B. & F. 348 ! 377 !).—Hills about Datta Khel (Dundas 72 !).
*S.W.*: Wana, 4,500 ft. (Duthie's Collect. 15785 !).—Jandola, along Tank River (F. 702 !).
*Flowers*: 20-3-30 (Datta Khel); 26-3-30 (Khajuri); 7-5-1895 (Wana); 26-5-27 (Jandola).
*Distribution*: W. Punjab, Sind, Afghanistan to Egypt.

**Hyoscyamus pusillus** L. Sp. Pl. (1753) 258.
*Locality*: *N.W.*: E. of Spinwam Fort, sandstone nala, 2,650 ft. (B. & F. 662 !).
*Fruit*: 1-4-30 (Spinwam).
*Distribution*: Mediterranean, Orient to the Altai.

### *Nicotiana L.

45 species.—America, Polynesia, 1 in Australia.

***Nicotiana Tabacum** L. Sp. Pl. (1753) 180.
*Vernacular name*: Tobacco Plant.
*Locality*: *N.W.*: Miram Shah (B. & F.).
*Flowers*: March (Miram Shah).
*Distribution*: Supposed to be a native of S. America, others say of Africa.

## OROBANCHACEAE.

140 species.—Chiefly N. temperate regions of the Old World, a few American and tropical.

### Orobanche (Tourn.) L.

90 species.—Temperate and subtropical regions.

**Orobanche amethystea** Thuillier Fl. Paris ed. 2, i (1797) 317, **var. hyrcana** G. Beck Monogr. Orob. (1890) 331.
*Locality*: *N.W.*: Near Miram Shah Fort, on bank of Chasmai River, in grass, 3,100 ft. (B. & F. 204 ! 230 ! 231 !).
*Flowers*: 23-3-30 (Chasmai).
*Distribution of var.*: N. Persia.

**Orobanche sp.**
*Locality*: *S.W.*: (Duthie's Collect. 15626 !).

## LENTIBULARIACEAE.

250 species.—Cosmopolitan.

### Utricularia L.

210 species.—Tropical and temperate regions.

**Utricularia sp.**—Flowers blue, large.
*Locality*: *S.W.*: Sur Dar Hills (Dundas !).
*Flowers*: 27-6-30.

(*To be continued*).

# THE PALM CIVETS OR 'TODDY CATS' OF THE GENERA *PARADOXURUS* AND *PAGUMA* INHABITING BRITISH INDIA.

BY

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## Part II.

(*With text-figures* 3 & 4).

(*Continued from page* 877 *of volume* xxxvi).

### Paradoxurus hermaphroditus nictitans, Taylor.

? *Paradoxurus leucopus*, Ogilby, *Zool. Journ.*, iv, p. 300, 1828.[1]

*Paradoxurus nictitans*, Taylor, *Journ. Bomb. Nat. Hist. Soc.*, vi, p. 429, 1891.

*Locality of type*: Kondmals, Orissa Division of S. Bengal.

*Distribution*: Southern Bengal.

The partial albinism of the typical example of *nictitans*, upon which Taylor established this 'species', has not the systematic value claimed for it; and Wroughton, without further inquiry, dismissed *nictitans* as a synonym of *niger*, the name he adopted for the Southern Indian form. But Taylor's specimens and one other that I have seen from Southern Bengal, present certain characters suggesting that they may prove to be racially separable from other Peninsular Indian forms; and, pending the collection of additional examples, I provisionally give *nictitans* the benefit of the doubt to prevent it being overlooked and to draw the attention of naturalists to the need of fresh material from that part of India. Its resemblances to *bondar*, described below, are unmistakable.

The Museum has three unmeasured, undated male skins from the typical locality, presented by Mr. J. H. Taylor and all affected by albinism. The type, immature, has only the head and shoulders normally coloured, the rest being white as shown by

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[1] This variety, based on a menagerie specimen without locality, will probably never be allocated. It is questionably inserted here because its partial albinism manifested by a white abdominal belt, white paws and end of the tail was similar to that of two of the three examples named *nictitans*. But it differed from the specimens I assign to the latter race in having the ground colour 'pale brown'.

Mr. Taylor's plate. The others have a broad white belt encircling the hind body and extending forwards and backwards over the ventral surface; the feet and the terminal third or more of the tail are also white, but the extent of the white varies in the two. Since the mother of the type was said to resemble her offspring, all the examples recorded from Kondmals are partial albinos, suggesting the prevalence of albinism in that district; but probably these specimens were preserved merely because of that peculiarity. No doubt normally tinted individuals occur there also. Where the coat is pigmented it is very similar in tint in the three specimens, the ground tint varying from clear grey to slightly buffy grey, overlaid to a varying extent by long black-tipped hairs, but the tail is mainly grey, the black being little in evidence. The pattern is indefinite and superficial. The coat is good but varies in length and thickness. In the type, known to have been killed in December, and in one of the others it is thick and full, with more underwool than in average examples of typical *hermaphroditus*.

At Pareshnath in Hazaribagh, some 240 miles to the north of Kondmals, Crump secured, on June 14, an adult ♀ which I assign to this race. The coat is long and rather shaggy, the under hair is grey and the black-tipped hairs are tolerably abundant. No pattern is traceable. Wroughton consequently identified the specimen as *crossi* which he said was bigger than *niger;* but this specimen is decidedly smaller, as the table of measurements shows.

| | In English Inches. | | | | In Millim. | |
|---|---|---|---|---|---|---|
| Locality, date and Sex | Head and Body | Tail | Hind foot | Weight | Wool | Hair |
| Kondmals, Orissa (type). Dec.; young ♂ ... ... ... | 20 | 18 | ... | ... | 26 | 45 |
| Kondmals, Orissa; ? date; just ad. ♂ | ... | ... | ... | ... | 26 | 39 |
| ,, ,, ,, ,, ♂ | ... | ... | ... | ... | 31 | 51 |
| Hazaribagh; June 14; ad. ♀ ... | 18⅗ | 19⅕ | 3 | 3 lbs. | 37 | 57 |

The body and tail measurements of the type were recorded by Mr. Taylor in his paper at the time of the animal's death. As a made-up skin it is nearly as large as the other two males, of which the dimensions were not taken.

The difference in the length of the coat of the type and of the example from Hazaribagh is considerable, but is probably to be explained by the coat not having attained its full length by

December in the type, whereas the Hazaribagh specimen was no doubt still carrying its winter coat in June.

The following are the measurements of the few available skulls:

| | In English Inches. | | | | | In Millimetres. | | |
|---|---|---|---|---|---|---|---|---|
| Locality and Sex | Total length | Zygom. width | Waist width | Int. orb. width | Max. width | Bulla | Pm¹ | M¹ |
| Kondamals, Orissa; just ad. ♂ ... | 4·1½ | 2·2½ | ·4½ | ·7 | ·7 | 15 | 7½ × 5½ | 5 × 7 |
| Kondamals, Orissa; just ad. ♂ ... | 4·0 | 2·1 | ·5 | ·7– | ·7 | 15 | 7 × 5 | 5 × 6½ |
| Kondamals, Orissa (type) young ♂... | 3·7½ | 1·8½ | ·5½– | ·6½ | ·6 | 14 | 6 × 5 | 5 × 7 |
| Hazaribagh ; ad. ♀ | 3·6½+ | 1·9+ | ·4½ | ·6 | ·6 | 14½ | 8 × 6 | 5 × 7½ |

The first skull on this list has apparently attained practically its total length. It has a long and narrow 'waist', with the temporal crests diverging far in advance of its narrowest point and

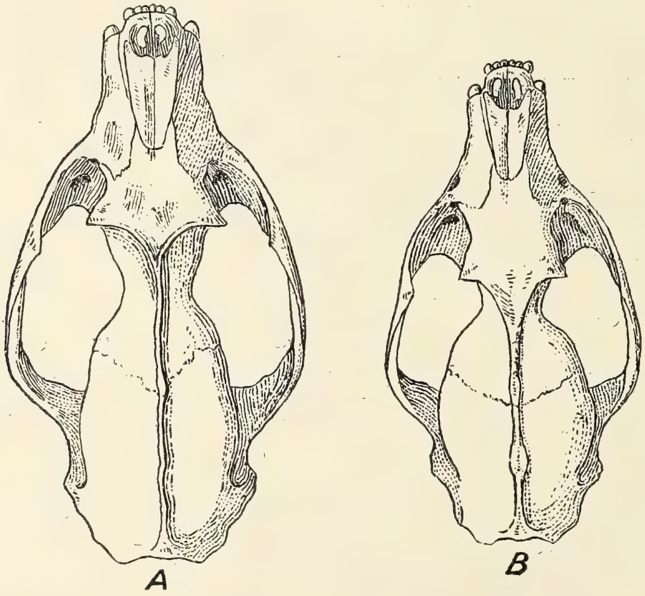

Fig. 3.—*A*. Skull of just adult male of *P. h. nictitans* from Kondamals, Orissa. *B*. The skull of adult female assigned to this race, from Hazaribagh. Both 2/3 nat. size.

forming behind a distinct but low sagittal crest, thick over the frontals, narrow over the parietals; the postorbital processes are quite short. The second skull, judging from the sutures, appears to be about the same age, but in other respects looks younger, the sagittal crest being lower and thinner, the ridges divergent a little farther back, the 'waist' shorter and a trifle wider and the postorbital processes shorter, 21 mm. from tip to tip as compared with 25 mm. in the larger skull. The skull of the type, of which the tooth change was described above (p. 174), is young. It has no sagittal crest, the temporal ridges being 5 mm. apart at the fronto-parietal suture and 8 in the middle of the parietals, the waist is wide but the postorbital processes from tip to tip are only 3 mm. narrower than in the largest skull. The largest skull is considerably smaller than the average size of male Indian skulls assigned to typical *hermaphroditus*, the nearest to it being the skull from Rorighat, Hoshangabad. It looks indeed like a female skull of that race. It must also be compared with a skull of a male collected by Crump at Singar in Gaya, some 300 miles to the north of Kondmals. This skull is a little larger, but considerably younger as shown by its more manifest sutures, lower, thinner sagittal crest and weaker divergent ridges on the frontals; the waist too is much shorter, and, despite the difference of age the postorbital processes are wider, 29 mm. as compared with 25 mm., and the frontals about half-way between the waist and the suture more salient and convex, 24 mm. instead of 20 mm. across. This skull indeed is much more like the skulls of typical *hermaphroditus*, *hirsutus* and *bondar* than is the ♂ skull of *nictitans*.

The female skull, assigned to *nictitans*, from Hazaribagh, some 250 miles north of Kondmals and geographically just south of Gaya, is evidently adult, there being hardly a trace of the sutures remaining, but it is considerably smaller than any adult female skulls of the other Indian races of *P. hermaphroditus*. The temporal ridges are weak and although almost meeting on the crown, they form hardly any saggital crest and become almost obsolete in front of their point of divergence a long way behind the 'waist'; the postorbital processes, as in the male skulls, are very short, only 19 mm. across. This skull is nearly the same size as the young female skull of *hermaphroditus* from Alnavar, Dharwar, entered in the table (vol. xxxvi, p. 874). But the latter is much younger, the temporal ridges being 7 mm. apart at the junction of the frontals and parietals and 10 mm. on the parietals where the vermiform suture between them is still very manifest; the postorbital processes also are much better developed, being 24 mm. from tip to tip. Judging by the sutures this Hazaribagh skull is as old as the ♀ skull of *bondar* from Rohilkand; but the latter is a much larger skull, with the sagittal crest slightly better developed, the divergent temporal ridges well defined in front of the waist and the postorbital processes 25 mm. from tip to tip. It is also noticeably smaller than the young ♀ skull from Darbanga which has the temporal crests wide apart.

### PARADOXURUS HERMAPHRODITUS SCINDIAE.[1] Subsp. nov.

*Locality of type*: Guna in Gwalior, about 40 miles N. of lat. 24°.

*Distribution*: Gwalior, Bhopal C.I., and probably Rajputana, i.e. the country drained by the Chambal and its tributaries, flowing N.E. into the Ganges.

*Description*: Distinguished from typical *hermaphroditus* of Southern India and Ceylon by its slightly larger size and, in winter, by its longer, more luxuriant coat, and less conspicuous black tips of the longer hairs. The pale ground colour varies from pure darker or lighter grey to slightly buffy grey, and owing to the length and fulness of the coat the pattern tends to be marbled or blotchy in type.

Several adult, subadult, and young specimens were collected for the Mammal Survey in various parts of Gwalior by J. Riley O'Brien. The recorded measurements of four of these from Guna (type), Binganj, Cachora Fort and Agar, are entered in the table below. There are, in addition, an unmeasured ♀ skin from Guna and four half-grown specimens from Binganj.

There are also in the Museum two unmeasured and unsexed skins, without skulls, collected in 1879 by Col. J. W. Yerbury at Neemuch (Nimach) about 140 miles W. of Guna. One, a ♂ judging from the skin, obtained at the Cantonment, 1,400 ft., in March, has the coat scanty but long, the general hue pale brown owing to the under hair, which is about 40 mm. being tawny, and the longer hairs, about 60 mm. blackish brown, as if faded, and the pattern is obscure and streaky. The other, obtained at Baval, near Neemuch, 1,500 ft., in April, has the coat of about the same length, but much fuller, and the general colour very different owing to the under hairs being clear grey and the long hairs normally black, forming a mottled pattern. Another skin ♀, of apparently the same race, was collected on April 29th, at Sehore in Bhopal, to the south of Gwalior, by Whitehead. The coat is thin and rather shaggy, as in the tawny example from Neemuch, but is about the same length; the general colour, however, is more like that of the example from Baval, but duskier owing to the deeper hue of the grey under hair. Sehore is only about 50 miles north of Hoshangabad, where the Palm Civets appear to be typical *hermaphroditus;* but the two places are separated by the Vindhya Range, Sehore being in the Chambal River system and Hoshangabad on the Narbada River. From the subjoined table of measurements it may be seen that the ♀ from Sehore, which may or may not be quite adult, there being no skull wherewith to settle the point, is larger than the adult males from Hoshangabad, and noticeably larger than the average size of females of *hermaphroditus*.

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[1] At the suggestion of Mr. W. S. Millard this race is named after H. H. the late Maharaja Sir Madhowrao Scindia, G.C.S.H., G.C.V.O., of Gwalior, commonly known as Maharajah Scindia, one of the first subscribers to the fund which enabled the Natural History Society of Bombay to start work in the field for the Survey of the Mammals of British India.

These three skins from Neemuch and Sehore, which were assigned by Wroughton to his imaginary species, *crossi*, are of some interest, because, collected in the spring, they retain some of the hairs of the full winter coat and indicate the length of coat O'Brien's specimens would have attained if they had lived till that time of the year.

I also assign to this race two skins, ♂ and ♀, collected on September 15th at Sambhar, Rajputana, by H. M. Adam and, like the examples from Neemuch and Sehore, identified by Wroughton as *crossi*. They are in poor coat, many of the longer hairs being shed; the general colour is dark grey, like the specimen from Sehore but with a slight tawny tint; the pattern is represented at most by indefinite lines. The body measurements of the female, an old animal, were lost with the original label. Those of the male, not quite full grown, are entered on the following table.

| Locality, Date and Sex. | In English Inches. | | | In Millimetres. | |
|---|---|---|---|---|---|
| | Head and Body. | Tail. | Hind Foot. | Wool. | Hair. |
| Guna, 1,564'; Oct. 28, (type), yg. ad. ♂ | 26½ | 22⅕ | 3½ | 30 | 52 |
| Binganj, 1,375'; Nov. 28, ad. ♀ | 26 | 24 | 3⅓ | 34 | 57 |
| Cachora Fort, 1,681'; Nov. 18; ad. ♀ | 24⅘ | 22 | 3⅕ | 28 | 45 |
| Agar Malwa; ? alt., Dec. 12; yg. ad. ♀ | 24⅗ | 20⅘ | 3 | 35 | 57 |
| Sehore, Bhopal, 1,700'; Apr. 29, ? ad. ♀ | 23⅕ | 21⅘ | 3¼ | 40 | 62 |
| Sambhar, Rajputana; Sept. 15; yg. ad. ♂ | 24⅖ | 23 | 3⅗ | 28 | 58 |

This table shows marked average superiority in the length of the head and body and of the tail over the examples assigned to *hermaphroditus*. The approximate average dimensions of the females of *scindiae*, for instance, are: head and body 24½ ins., tail 22 ins.; of *hermaphroditus*, head and body, 21½ ins., tail 20 ins. The hind feet are about the same length.

The measurements also attest average superiority in the length of the coat, at its best, in *scindiae*. By taking examples of the two races killed between and including December and April, before the winter coat is moulted, the average length of its two constituents can be estimated. In *scindiae* the approximate average of the 'wool' is 45 mm., of the long hairs 60 mm.; the corresponding measurements in *hermaphroditus* being about 30 mm. and 53 mm.

Skull-measurements are as follows:—

| Locality and Sex. | In English Inches | | | | | In Millimetres. | | |
|---|---|---|---|---|---|---|---|---|
| | Total length | Zygom. width. | Waist. width. | Int. orb. width. | Max. width. | Bulla | $Pm^4$ | $M^1$ |
| Guna (type) yg. ad. ♂ | 4·5 | 2·4 | ·5 | ·7– | ·8 | 16 | 8×6 | 5×7 |
| Binganj. ad. ♀ | 4·4 | 2·4 | ·5– | ·7½ | ·7+ | 16 | 8×6 | 5×7 |
| Agar Malwa, yg. ad. ♀ | 4·2 | 2·2 | ·5 | ·7 | ·7 | 17 | 8×5½ | 5×7 |
| Cachora Fort. ad. ♀ | 4·1 | 2·3 | ·5 | ·7½ | ·8– | 15½ | 8×6 | 6×8 |
| Guna. yg. ♀ | 4·0 | 2·1 | ·5 | ·6 | ·6½ | 15 | 7×5– | 5×6½ |
| Sambhar, Rajputana; yg. ad. ♂ | 4·4 | 2·3½ | ·5 | ·8– | ·8 | 18 | 8½×7 | 6+×8 |
| Sambhar, Rajputana; old. ♀ | 4.1½ | 2·4 | ·4+ | ·7 | ·8– | 17½ | 8×6½ | 5×7½ |

From the data supplied by this table it cannot be claimed that the skulls of this race are larger than those of typical *hermaphroditus* of Southern India, despite the superiority in the bodily dimensions. The skulls are similar and vary similarly in the two races. The difference in the size of the teeth between the females from Guna and Cachora Fort is very noticeable; and the difference, of course, has nothing to do with the difference of age.

### PARADOXURUS HERMAPHRODITUS LANEUS, subsp. nov.

*Locality of type*: Gopalpur, 5,200 ft., in Kangra.

*Distribution*: Kangra, in the Upper Punjab, from 2,000 ft. to 7,000 ft.

Nearly resembling *scindiae* from Gwalior in size and general appearance, but with the winter coat fuller, more woolly, perceptibly more resistant to the touch; the long hairs are not so extensively black terminally and there is more black on the sides of the neck.

Five adult and young adult examples collected in March by H. W. Wells for the Mammal Survey at Gopalpur in Kangra 5,200 ft. and 7,000 ft. and in the Kangra Valley 2,000 ft. to 2,500 ft. There is in addition a flat, undated, unsexed skin probably procured from a native.

In the typical example, an oldish ♂ from Gopalpur, 5,200 ft., March 6 (collector's No. 2173), the colour is buffy grey and black in about equal proportions, the black forming a rather irregular pattern of lines and spots, somewhat mottled or marbled; the coat is luxuriant and upstanding, with the wool deep reaching almost as high as the summit of the pale area of the long hairs which, erected by it, do not conceal with their black tips the lower pale areas of the coat. The brow-band is not so conspicuous as in the rest of the specimens, being interrupted by black which reduces it to a pair of grey patches on the forehead and a grey patch above the posterior corner of each eye. A young ♂, with milk teeth, from Gopalpur, 7,000 ft., March 3 (No. 2166), is almost identical with the type in colour and pattern, but grey with no buff on the belly; the coat is beginning to come away on the rump. In most of the other specimens, taken at lower levels in the Kangra Valley, 2,000 to 2,500 ft., the coat is still luxuriant but shows signs of breaking with the moult, the dates of their capture being a fortnight or more later. One of them, a ♀ skin (No. 2253) is buffier grey than the type and has the pattern much less distinct. Another, a ♂ skin (No. 2211) has lost a lot of the black-tipped hairs on the rump, the wool remaining. Finally, the skin of an adult ♀, March 28 (No. 2285), apparently suckling young to judge from the size of the mammae and the nakedness of the surrounding skin, is in full moult, as recorded below. Apart from its size this skin is not distinguishable from skins of typical *hermaphroditus* similarly moulting.

The recorded flesh-measurements and weights are as follows:—

| Locality, Date and Sex | Head and Body | Tail | Hind Foot | Weight | Wool | Hair |
|---|---|---|---|---|---|---|
| Gopalpur, Kangra, 5,200′ ; Mar. 6 ; ad. ♂ | 27⅕ | 24⅕ | 3⅗ | 9 lbs. | 40 | 62 |
| ,, ,, 7,000′ ; Mar. 3, immat. ♂ | 22⅕ | 21⅗ | 3⅕ | 6 ,, | 35 | 47 |
| Kangra Valley, 2,000′ ; Mar. 26 ; yg. ad. ♂ | 26⅘ | 25 | 3⅗ | ... | 41 | 52 |
| ,, ,, ,, Mar. 21 ; ad. ♂ | 23⅕ | 22⅘ | 3⅖ | ... | 40 | 60 |
| ,, ,, 2,500′ ; Mar. 25 ; ad. ♀ | 25⅕ | 24 | 3⅕ | ... | 41 | 63 |
| ,, ,, 2,000′ ; Mar. 28 ; ad. ♀ | 26⅘ | 25⅗ | 3⅗ | ... | ... | ... |

The flesh-measurements here recorded agree tolerably closely with those of *scindiae*.

To the skull measurements of *laneus* given below, are added those of the Kashmir race next described.

| | In English Inches | | | | | In Millimetres | | |
|---|---|---|---|---|---|---|---|---|
| Locality and Sex | Total length | Zygom. width | Waist width | Int. orb. width | Max width | Bulla | Pm$^4$ | M$^1$ |
| *laneus* | | | | | | | | |
| Kangra, Gopalpur (type) ad. ♂ | 4·7 | 2·8 | ·5 | ·9½ | ·9 | 18 | 10 × 7 | ... |
| ,, ,, immat. ♂ | 4·1 | 2·2 | ·5½ | ·7 – | ·7 | 16 | ... | ... |
| ,, Valley; yg. ad. ♂ | 4·7 | 2·6 | ·5 + | ·8 | ·7½ | 18½ | 9 × 7 | ... |
| ,, ,, ad. ♂ (? ♀) | 4·4½ | 2·4 + | ·5 | ·7½ | ·8 – | 18½ | 9 × 6 | 6 × 8½ |
| ,, ,, yg. ad. ♀ (? ♂) | 4·6½ | 2·5 | ·5½ | ·8 | ·8 – | 19 | 9½ × 7 | ... |
| ,, ,, ad. ♀ | 4·3½ | 2·3½ | ·5 + | ·8 – | ·7½ | 19 | 9 × 6 | 6 × 8 |
| *vellerosus* | | | | | | | | |
| Kashmir; yg. ad. ? ♂ | 4·9½ | 2·7½ | ·6 | ·9½ | ·8½ | 20 | 9 × 7 | 6 × 7 |

In the list of the Kangra specimens the queries regarding the sex of the fourth and fifth skulls are explained below.

The first on the list, the type of *laneus*, is fully adult, rather old indeed judging from the worn teeth. It is well developed and similar to the skull of *hermaphroditus* from Bellary with the temporal ridges strong where they meet over the waist and running into a large sagittal crest, 8 mm. high, the postorbital processes wide and salient, 41 mm. from tip to tip, exceeding that dimension in any other Indian skull and the zygomatic arches at their level 65 mm. across. The third skull still has the basioccipital suture open and would probably have exceeded the type-skull when full grown. I believe, however, that the fourth and fifth skulls, respectively marked ♂ and ♀, have had their labels exchanged. The fourth (collector's No. 2211) is approximately as old as the type skull, but it has all the characters of a female skull and almost exactly matches the last on the list (No. 2285) which belongs to the ♀ skin in moult. It is comparatively small, with the temporal ridges weak over the waist, forming a crest from 1 to 2 mm. high on the frontals and separated on the parietals; the postorbital processes are only 30 mm. across and the zygomatic arches on a level with them only 54 mm. wide. The fifth skull, on the contrary, marked ♀ (No. 2253) almost exactly resembles the third on the list, a young adult ♂ (No. 2265), and would probably have exceeded the type in size when full grown.

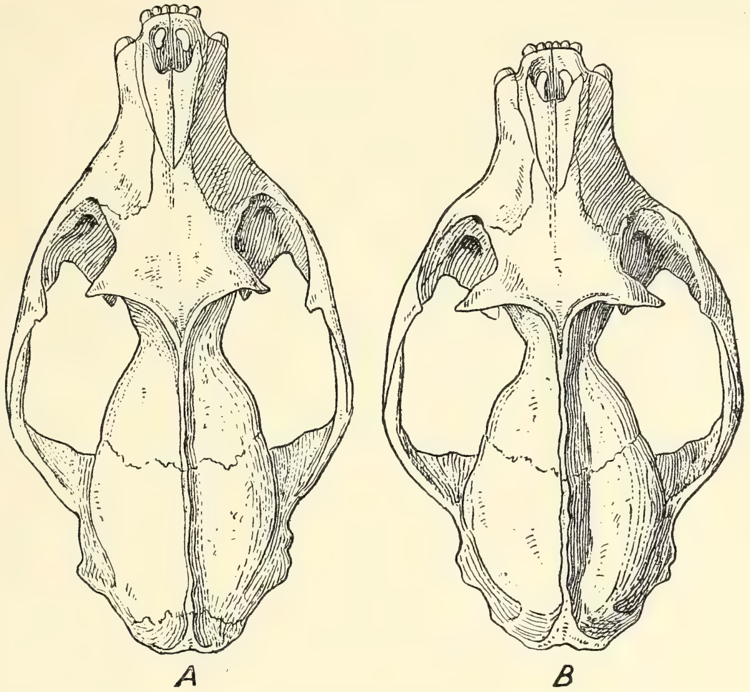

Fig. 4.—*A*. Skull of young adult male (type) of the Kashmir race (*P. h. vellerosus*. *B*. Fully adult male skull of the Kangra race (*P. h. laneus*). Figs. 2/3 nat. size.

The immature dimensions of the second skull on the list have been added to show the size with the milk teeth still functional and the permanent set, although ready to erupt, still beneath the gum.

Although the data are few and not very satisfactorily comparable, the measurements in this table attest slight superiority of the skulls of *laneus* over those of *scindiae* in all the dimensions cited, except the waist. The bullae and teeth are also a little bigger.

### PARADOXURUS HERMAPHRODITUS VELLEROSUS, subsb. nov.

*Locality of type and only known specimen*: Kashmir.

Like the type of *laneus* from Gopalpur, 5,200 ft., in Kangra, in colour and pattern but with a larger skull and a better coat, the woolly under hair about 50 mm. long, the longer hairs about 60 mm.

On the made-up skin the tail measures 28 in.; on the similarly made-up skin of the type of *laneus* the tail is 25½ in., the head and body being about the same in the two specimens.

The type of this race (B.M. No. 23.9.1.17), purchased from Mrs. Entwistle, is apparently the first example of *Paradoxurus* received from Kashmir, although Col. Ward recorded the occurrence of the genus in that country.

The skull, of which some measurements are given in the table, with a total length of 125 mm. and a condylo-basal length of 122 mm., is the longest *Paradoxurus* skull I have seen, the corresponding measurements of the typical skull of *laneus* being respectively 119 mm. and 118 mm. The skull, nevertheless, is decidedly younger; and since the basioccipital suture is still visible, it had probably not reached its full length and had certainly not attained complete development in other respects. The sagittal crest, for instance, is only 4½ mm. high, just surpassing half the height of the crest in the type of *laneus*, the ridges in front of it are weak and diverge from a point on a level with the narrowest part of the longish waist, the postorbital processes are only 34 mm. from tip to tip, and the zygomatic arches at their level 60 mm. wide, the same measurements in the type of *laneus* being respectively 45 mm. and 65 mm., and the cranium is narrower at the level of the posterior root of the zygomatic arches. No doubt it would have surpassed the typical skull of *laneus* in those respects with development.

## PARADOXURUS HERMAPHRODITUS BONDAR, Desm.

*Viverra bondar*, Desmarest, *Mamm.*, p. 210, 1820.

*Paradoxurus bondar*, Gray, *Illustr. Ind. Zool.*, pl. xii, 1833; *id. Proc. Zool. Soc.* 1864, p. 531.

*Paradoxurus pennantii*, Gray, *Proc. Zool. Soc.* 1832, p. 66; *id. Illustr. Ind. Zool.*, pl. xiii, 1833.

*Paradoxurus crossi*, Gray, *Proc. Zool. Soc.* 1832, p. 67; *id. Illustr. Ind. Zool.*, pl. vii, 1833.

*Paradoxurus hirsutus*, Hodgson, *Asiat. Res.*, xix, p. 72, 1836.

*Paradoxurus strictus*, Horsfield, *Ann. Mag. Nat. Hist.* (2), xvi, p. 105, 1855; id. *Proc. Zool. Soc.* 1856, p. 396, pl. 47.

*Locality of type* of *bondar*: Bengal.
*Locality of type* of *pennantii*: Higher Province of Bengal.
*Locality of type* of *crossi*: 'India'.
*Locality of type* of *hirsutus*: Nipalese Tarai.
*Locality of type* of *strictus*: Nepal Tarai.
*Distribution*: Rohilkund and 'the open parts of Nipalese Tarai and generally in British districts on the left (north) side of the Ganges to Northern Bihar' (Hodgson); Bengal (Desmarest).

*Description*: Closely resembling *scindiae* and *laneus* in the length and luxuriance of the winter coat, the under hair long and thick so that the longer black-tipped hairs are raised, not lying smoothly as in *hermaphroditus;* the pattern less pronounced than in *scindiae* and *laneus*, sometimes evanescent and when indicated formed by the confluence of the black tips of the longer hairs and therefore readily disarranged; general colour varying from nearly white to pale whitish grey with a faint buff tinge or to conspicuously 'yellow' or tawny.

This Survey only procured a few examples assigned to this race and there are only two, or possibly three, in Hodgson's collection.

I see no reason for dissenting from Gray's determination of Desmarest's *bondar*. Blanford, on the contrary, reversing Gray's decision, quoted *bondar* as a synonym of *niger*, although Desmarest's descriptions of the two emphatically attest their distinctness and the characters he assigned to *bondar* contradict the diagnosis of *niger* given by Blanford in his analytical key. According to Desmarest his description of *Viverra bondar* was taken from a sketch, sent to him by Blainville, which was alleged to be a copy of an unpublished coloured drawing seen by him in London of a specimen from Bengal named 'Ichneumon bondar'. The original painting, by Buchanan Hamilton, was in the possession of the East India Company. Blanford examined it, and without comparing it with Desmarest's description of *bondar*, came to the conclusion that it represented the South Indian Palm Civet (*niger*). I do not agree with that opinion, but the point is of no importance because Buchanan Hamilton's painting is not the type of *bondar* as Blanford claimed. The type is Blainville's alleged copy of it. I say 'alleged' because the original painting, still preserved at the India Office, where I was courteously allowed to see it, differs in several points from Desmarest's description of *bondar* and suggests that Blainville inaccurately copied it, possibly modified his drawing from a specimen in his possession which he identified as Buchanan Hamilton's 'bondar'.[1] For the determination of *bondar*, therefore, we are dependent upon Desmarest's description, which states that the coat is very thick and tawny in tint with the points of the longest hairs black, the pattern consisting of a median dorsal stripe continued all along the tail and of two narrow parallel bands extending along the flanks from the shoulders to the croup; the tail is black in its terminal third and below the eye there is a grey patch surrounded by black continuous with a black patch on the sides of the muzzle.

The type of *pennantii* was a coloured sketch by Hardwicke of a specimen from the Higher Province of Bengal which in those days extended westward to the frontier of Oudh, south of the Nepal Tarai. The reproduction of it in *Illustrations of Indian Zoology* represents the body and at least the proximal half of the tail as tolerably uniformly tawny buff with some darker streaks running over the flanks from the shoulders to the root of the tail. Gray himself, in his revision of 1864 dropped the name as a synonym of *bondar* and I accept that decision. By Blanford *pennantii*, without any apparent reason, was added to the synonymy of his *niger*.

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[1] Even more manifest are the discrepancies between Desmarest's description of *Viverra prehensilis*, which has the same history as *bondar*, and Buchanan Hamilton's original painting. According to the latter, for instance, only the basal third of the tail is the same colour as the rump and its tip is white. Desmarest's description of Blainville's alleged copy says the 'greater part' of the tail is the same colour as the body and the tip black. The identification of Desmarest's *prehensilis* is, however, of no particular importance, the name being preoccupied.

The type of *crossi*, said to have come from India and exhibited in the Surrey Zoological Gardens, was drawn while still alive and the figure, reproduced in *Illustrations of Indian Zoology*, depicts the body as yellowish or buff all over without trace of definite pattern of lines or spots, and covered with a luxuriant, obviously woolly, coat. It unmistakably resembles Hodgson's unpublished drawings of his *hirsutus* and is quite unlike any specimens of Palm Civets I have seen from Southern India. But a skin in the British Museum, labelled as the type, is very different from the sketch. The coat is thick, but quite short and harsh, dirty whitish grey in hue superficially, although buffy beneath, and irregularly blotched with black. It similarly disagrees with Desmarest's description of *bondar*, with Gray's illustrations of the latter and of *pennantii*, and with Hodgson's description of *hirsutus*. In my opinion it cannot with confidence be regarded as the type of *crossi*, a belief which probably arose from its coming from the Surrey Zoological Gardens, which is of course unsatisfactory evidence. Blanford cited *crossi* as a synonym of *niger*, an opinion unsupported by Gray's original figure and by the alleged type specimen.

Hodgson described *hirsutus* as 'full clear yellow, largely tipped with black and entirely void of markings or lines (definite pattern), the brow band pale yellow, the long hairs free and erectile, not applied to the body and 2¼ ins. (57 mm.) long, and the yellow wool, greyish basally, more than half their length. This example was evidently in perfect coat. For this and other reasons it is impossible to accept Thomas's decision that one of Hodgson's originally unnamed examples in the British Museum is the type of *hirsutus*, for in this specimen (No. 43.1.12.119) the coat is in poor condition owing to the moult and, apart from the faint tawny tinge on the back, the pale areas of the long hairs, which are only about 43 mm. and scanty on the rump and flanks, are mostly pale grey and the distal portion of the wool, which is about 25 mm. deep is the same tint, as also is the brow-band, instead of yellow as in Hodgson's example. Moreover, the black tips of the long hairs form by their confluence an indistinct pattern. It would be impossible to guess the racial identity of this skin if its locality were unknown. By Blanford it was mistaken for *niger*. Wroughton called it *crossi*. I assign it to *bondar*, because of some resemblance it shows to the examples from Rohilkand described below. Hodgson, it may be added, appears to have seen a good many examples like his type of *hirsutus*, which he thought was the same animal as *bondar*, Desm., for he recorded the species, as quoted above, from the Nepal Tarai and the adjoining British territories to the north of the Ganges, including northern Bihar.

I add *strictus* to the synonymy of *bondar* because Horsfield, who adopted Hodgson's M.S. name for the species, declared the type came from Nepal Tarai. This type (No. 79.11.21.546) in the British Museum is otherwise unidentifiable as *bondar* on account of the condition of the skin, which is in moult. No doubt Hodgson considered it to be specifically distinct from those he called *hirsutus* because he was unaware of the profound effect of coat change on colour and pattern. But admittedly it is extremely unlikely that two distinct forms occur in the Nepal Tarai. The skin exhibits a later stage of moult than that of the alleged type of *hirsutus*, as recorded above (p. 184).

According to Hodgson, as above quoted, *hirsutus* is found in British territory between the Ganges and the Nepal Tarai, as well as in the Tarai itself; and two handsome skins in full winter coat collected by Crump on March 8th, at Pilibhit, 800 ft., in Rohilkand, seem to belong to this race. Wroughton identified them as *crossi*. They apparently only differ from those seen by Hodgson in having the luxuriant woolly coat, which is 35 to 37 mm. long, white or silvery grey instead of clear yellow, with a pale slate-tint at the base. The difference in colour, similar to that which occurs in *hermaphroditus*, *pallasii* and other races, is possibly due to fading of the coat in March before the summer moult. The brow band also is white, the abdomen pale grey, the throat smoky grey. The dorsal surface is sprinkled with the black tips of the longer hairs, from 50 to 55 mm. in length, which at most show the faintest possible tawny tinge below the black. The pattern is vague, hardly to be described as consisting of definite black stripes and spots, but rather as irregular, elongated patches resulting from the confluence of the black tips of the longer hairs and therefore readily dissarranged. The basal half of the tail is, like the back, white, sprinkled with black. Of the two skins, one has no skull or measurements and cannot be sexed. The other is that of an oldish ♀. In the character of the pelage they resemble the examples of *scindiae* from Gwalior; but differ from them strikingly in general colour briefly describable as white with copious black speckling, the precise reverse of the colour of the winter coat of the 'silver-tip' fox, which is black with white speckling.[1]

Two additional skins, collected by Baptista in Darbhanga, 150 ft., support in a measure Hodgson's claim, likely enough to be true, that *hirsutus* occurs in N. Bihar, south of the eastern end of the Nepal Tarai. But both skins, owing to the time of the year, are in bad coat, differing in tint and in length and luxuriance from the March skins from Rohilkand. One (September 6), a young adult ♂ by the skull, has the wool shabby, thin and short, about

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[1] An adult ♂ skin and skull in Hodgson's collection, referred to below under *pallasii*, may belong to this race. The skin hardly differs from the Rohilkand skins in coat and colour; but the skull agrees better with that of *pallasii*.

20 mm. long; and dull grey in colour with here and there a tinge of tawny buff; there is a good deal of grey about the head. A few long hairs, 30 mm., are present on the hind-back, but there are more on the fore-quarters. The pattern is represented on the short coat of the back by three irregular stripes. The tail is in better condition, clothed in its basal half with clear grey wool, 30 mm., and sprinkled with the black tips of the longer hairs, 40 mm., thus closely resembling the tail of the Rohilkand skins. The second skin, an adult but not old ♀ (July 28), is generally similar to the last in coat and colour; the grey wool of the back is about 23 mm. and the long hair about 47 mm., but the dark tips of the hairs and the pattern have a decided brownish tinge as if faded. The large size of the teats and the naked area round them show that this specimen was suckling young. This skin, in general appearance and the state of the coat, closely resembles a skin of typical *hermaphroditus* collected on July 25 (? 27) by Baptista in the Palkonda Hills; but the long hairs are not so coarse and the wool is softer and silkier to the touch. A kitten from Darbhanga (*C. M. Inglis*) September 28, has abundance of greyish buff wool, with the longer black tipped hairs rather sparse and the pattern obscure.

The following table gives the available flesh measurements:—

| | In English Inches. | | | | In Millimetres. | |
|---|---|---|---|---|---|---|
| Locality, Date and Sex. | Head and Body. | Tail. | Hind Foot. | Weight. | Wool. | Hair. |
| 'Nepal Tarai' (Hodgson) ♂ | 23 | 22 | ... | 6 lbs. | 35 | 58 |
| Rohilkand; Mar. 8; old ♀ | 20 | 18 | 3– | 4 ,, | 35 | 50 |
| ,, Mar. 8; ? sex. | ... | ... | ... | ... | 37 | 55 |
| Darbhanga; July 28; yg. ad. ♀ | 18 | 19 | 3⅛ | ... | 23 | 47 |
| ,, Sept. 6; yg. ad. ♂ | 20 | 18 | 3½ | 8 lbs. | 20 | 30 |

The length of the wool in Hodgson's specimen has been roughly estimated from his statement that it exceeds half the length of the long hairs. It seems probable that that specimen, like those from Rohilkand, was in full winter coat. The difference in coat length between the two examples from Darbhanga is probably to be explained by the retention of the long hairs of the winter coat in the July specimen.

To the following table of skull measurements of the examples from Rohilkand and Darbhanga are added those of three skulls, without skins and unsexed, belonging to Hodgson's collection; but they may belong to the following race *pallasii.*

| | In English Inches. | | | | | In Millimetres. | | |
|---|---|---|---|---|---|---|---|---|
| Locality and Sex. | Total length | Zygom. width | Waist width | Int. orb. width | Max. width | Bulla | Pm⁴ | M¹ |
| Darbhanga; yg. ad. ♂ | 4·3 | 2·3 | ·5– | ·7 | ·8– | 16½ | 7½ × 5 | 5½ × 7 |
| Nepal (Hodgson) yg. ad. ? sex | 4·3 | 2·2 | ·4½ | ·8 | ·7 | 15 | 7½ × 5 | 5 × 7 |
| Do. yg. ad. ? sex | 4·2 | 2·2 | ·4 | ·7 | ·7– | 16 | 8 × 6 | 6 × 7 |
| Do. yg. ad. ? sex | 4·1 | 2·0 | ·5 | ·6 | ·7– | ... | 7 × 6 | 5 × 7 |
| Rohilkand; old ♀ | 4·1 | 2·2 | ·5– | ·7 | ·6 | 15 | 7½ × 5 | 6 × 7½ |
| Darbhanga; yg. ad. ♀ | 3·8½ | 2·0 | ·5½ | ·6½ | ·6¾ | 14 | 8 × 5 | 6 × 8 |

The skull from Rohilkand is entered as old because the teeth are much worn, perhaps not a convincing reason. It is about as large as the smallest ♀ skulls of *scindiae* and *hermaphroditus;* but the cranial material of this race is too inadequate for discussion.

### PARADOXURUS HERMAPHRODITUS PALLASII, Gray.

*Viverra prehensilis,* Desmarest, *Mamm.,* p. 208, 1820 (not of Kerr, 1792).

*Paradoxurus albifrons* Ogilby, 1831 (unpublished at the time and preoccupied).

*Paradoxurus pallasii,* Gray, *Proc. Zool. Soc.* 1832, p. 67; *id. Illustr. Ind. Zool.,* pl. viii, 1834 and subsequent papers.

*Paradoxurus quadriscriptus,* Horsfield, *Ann. Mag. Nat. Hist.* (2), xvi, p. 106, 1885; *id. Proc. Zool. Soc.* 1856, p. 396, pl. 48.

*Paradoxurus vicinus,* Schwarz, *Ann. Mag. Nat. Hist.* (8), vi, p. 230, 1910.

*Paradoxurus strictus,* Wroughton, *Journ. Bomb. Nat. Hist. Soc.,* xxv, p. 48, 1917 (not *P. strictus,* Horsfield).

*Locality of type* of *prehensilis*: Bengal (Buchanan).

*Locality of type* of *pallasii*: India (Buchanan, probably therefore Bengal).

*Locality of type* of *quadriscriptus*: Nepal, in the hills.

*Locality of type* of *vicinus*: Probably Assam (McClelland).

*Distribution*: Nepal, Sikhim, Upper Bengal, Assam and Upper Burma.

*Notes on the synonymy*: The name *prehensilis,* referred to above under *bondar,* was based upon an alleged copy by Blainville of a painting by Buchanan Hamilton of a Palm Civet from Bengal. The description leaves no doubt that the name, if available, should be adopted for the race under notice; but, as Blanford pointed out, Kerr in 1792 called the American Kinkajou *Viverra prehensilis*. About the name *pallasii* there has been much difference of opinion. It was given to a living specimen in the Zoological Gardens brought by Buchanan (afterwards Buchanan Hamilton) from India, no doubt Bengal, where Buchanan was resident. A coloured drawing of it, also taken from the living animal, was published by Gray, and this seems to have misled Temminck into thinking that the animal was the same as the previously described Javan form he named *musanga*, an opinion which in 1864 was tentatively adopted by Gray himself in defiance of the history of the specimen he himself recorded. By Blanford *pallasii* was cited as a synonym of *hermaphroditus* on account presumably of the distinctness of the pattern depicted in the plate; and according to his application of the name *hermaphroditus* this verdict was correct. Wroughton considered *pallasii* to be synonym of the species he called *crossi* because the pattern is obscured by the bad make-up of the skin of the type preserved in the British Museum.

The plate in question is most misleading. It agrees neither with Gray's description nor with the specimen. The body colour is represented as slate grey and the brow band is unusually large and conspicuously white. In the type the ground colour is pale, faintly buffy whitish grey, noticeably paler than the brow-band which is buffy grey, not so extensive as in the plate and with considerably more deep brown round and between the eyes. The pattern, although disarranged, as stated above, by the 'make-up' of the skin consists of black dorsal stripes and lateral spots. The coat was apparently new at the time of the animal's death, but although not so thick with underwool or so long as in the winter coated specimens recorded below, is of similar soft texture and differs in this respect from the coat of the Burmese race assigned to *ravus*. The colour is clearer grey than in the palest of the specimens above referred to, but the difference is not nearly so great as between the palest and richest tinted examples of the series.

Horsfield's type of *quadriscriptus* which, on Hodgson's authority, came from the hills of Nepal, I cannot distinguish from several specimens collected for the Survey in Sikhim, Bhutan Duars, Upper Bengal and Assam. The type of *nigrifrons*, Gray, a menagerie specimen from India, closely resembles the type of *pallasii*, and has the pattern similarly obscured by the 'make-up' of the skin but is decidedly more buffy grey in ground tint. The type of *vicinus*, one of McClelland's specimens and probably from Assam, is indistinguishable from examples from Bhutan Duars. Wroughton correctly identified this race but called it *strictus* because of the distinctness of the pattern, due in reality to the moult, in the type of the latter.

*Description:* Winter coat full, soft, with abundance of underwool but shorter than in *bondar*, *laneus* and *scindiae;* general colour of the under hair varying from clear grey through shades of buffy grey to rich ochreous and only slightly dimmed by the black tips of the longer hairs; pattern well defined and at its best composed of spots on the flanks, thighs and shoulders and of five dorsal stripes, the right and left externals broken into spots, the median often not passing as far forwards as the shoulders; head with a pale patch on each side of the muzzle and below the eye, the brow-band varying in greyness, typically more or less interrupted by black speckling in the middle line and above the anterior angle of the eye; throat black; belly varying from grey to rich buff in the same locality; tail black at the end, generally obscurely striped in its proximal portion where the pale areas of the hairs and of the wool are exposed.

In addition to the types of *pallasii* and *nigrifrons*, already referred to, the British Museum has the following specimens:—

An old ♂ from Nepal, belonging to Hodgson's collection, but received without a name, I am very doubtful about. It is nearly intermediate between the pale examples of *bondar* from Rohilkand and the type of *quadriscriptus*. The ground colour is decidedly whitish, but the pattern is distinct although superficial and resulting from the confluence of the black tips of the long hairs (see note on the skull).

The type of *quadriscriptus* from the hills of Nepal has the coat in good condition, full and with the long hairs about 40 mm., their black tips surpassing by about 10 mm. the underlying pale portions which are buffy grey in tint; the pattern consists of very distinct stripes extending from the shoulders to the rump. Allowing for a certain amount of fading this skin agrees tolerably closely with Horsfield's description and with his coloured figure; but the fur, although soft, is not long and straggling, as he said.

An old ♂ from Narbong, Darjiling, 2,000 ft. (*Crump*), March 13, closely matches the type of *quadriscriptus* in coat, colour and pattern.

An adult pair from Sivok in Upper Bengal, S. of Darjiling, (*Crump*), March 26. Except for its rather longer coat the ♀ almost exactly matches the specimen from Narbong. The ♂ has the coat as in the latter but the colour is decidedly more buffy.

An adult ♂ from Hasimara, Bhutan Duars, 600 ft. (*C. Crump*), December 29, is pale buff like the ♂ from Sivok. Another adult ♂, January 6, is richer buff than any of the preceding, almost orange-ochreous buff in tint. There are also several immature specimens from this locality resembling the adults and similarly varying from greyish buff to almost orange-ochreous buff; the bellies similarly vary from grey to buff.

A young ♂ from Haldibari in Cooch Behar. 150 ft. (*C. Crump*), April 17, is in poor coat, apparently beginning to change; the hind-back, rump and root of tail are decidedly buffy, but the bright hue dies away forwards.

A flat, unmeasured ♂ skin from the Duranga River, North Kamrup (*Wells*), February 10, is hardly distinguishable from the specimen from Narbong, Darjiling.

A flat, unsexable skin from Dura Banda, Garo Hills (*Wells*), March 12, is tawny buffish grey in tint, intermediate between the paler and better coloured varieties.

An old ♂ and a young adult ♂, both unmeasured, from Golaghat in Sibsagar, north of the Naga Hills, Assam (*Wells*), January 10 and 26, are rich ochreous buff in colour with the pattern well defined, like the richest tinted of the skins from Bhutan Duars. The coat measurements are 28 and 32 mm., and 32 and 40 mm. respectively.

An adult mounted specimen from Cachar, Assam (*Rowland Ward*), has the ground colour pale buffy white, the pattern well defined, the brow-band reduced to two grey patches on each side and the grey muzzle-patch suppressed; the coat is 24 and 36 mm.

Two young adult ♀ examples (*McClelland*), probably from Assam. One, the type of *vicinus*, resembles in the coat, which is 27 and 37 mm., and in colour, the brighest tinted skins from Bhutan Duars and Golaghat. The other, with similar coat, is considerably greyer, like the less brightly tinted of the previously described skins.

A young specimen from the Uvu Forest, 60 miles East of Homalin in Upper Chindwin, and indistinguishable in coat and colour from the richly tinted Assamese examples, attests the extension of *pallasii* into N.-W. Burma.

The following are the specimens in which flesh measurements are available:—

| | In English Inches. | | | | In Millimetres. | |
|---|---|---|---|---|---|---|
| Locality, Date and Sex. | Head and body | Tail | Hind Foot | Weight | Wool | Hair |
| Hasimara, Bhutan Duars; Dec. 29; ad. ♂ | 24⅖ | 23 | 3⅗ | ... | 29 | 37 |
| Hasimara, Bhutan Duars; Jan. 6; ad. ♂ | 23⅕ | 22⅕ | 3½ | ... | 26 | 34 |
| Sivok, Upper Bengal; Mar. 26; ad. ♂ | 22 | 21⅓ | 3⅗ | ... | 25 | 38 |
| Haldibari, Cooch Behar; Apr. 17; yg. ♂ | 20 | 21⅘ | 3½ | 5¾ lbs. | 22 | 36 |
| Duranga River, N. Kamrup; Feb. 10; ♂ | 22 | ... | 3⅕ | 5 ,, | 27 | 38 |
| Sivok, Upper Bengal; Mar. 26; ad. ♀ | 22⅗ | 22⅕ | 3½ | ... | 34 | 43 |

This table shows inferiority in size of *pallasii* as compared with *laneus* and *scindiae* and superiority over *hermaphroditus*. The winter coat also is shorter both in wool and long hair than in *bondar*, *laneus* and *scindiae*, and the long hairs are shorter than in *nictitans* and *hermaphroditus*.

Cranial and dental measurements: —

| | In English Inches. | | | | | In Millimetres. | | |
|---|---|---|---|---|---|---|---|---|
| Locality and Sex | Total length | Zygom. width | Waist width | Int. orb. width | Max. width | Bulla | $Pm^4$ | $M^1$ |
| Nepal (Hodgson) old ♂ ... | 4·7½ | 2·5 | ·4 | ·8½ | ·8 | 22 | 9 × 5½ | 6 × 8 |
| Nepal (Hodgson) yg. ad. ♂ ... | 4·5 | 2·3½ | ·5 | ·8 | ·8 | 18 | 7? × 6 | 5 × 7 |
| Narbong, Darjiling; old ♂ ... | 4·5 | 2·5½ | ·4 | ·7½ | ·8 | 18 | 9 × 6 | 6½ × 7 |
| Hasimara, Bhutan Duars; ad. ♂ ... | 4·7 | 2·5 | ·4 | ·8 | ·8 | 19 | 8 × 6 | 6 × 7 |
| Hasimara, Bhutan Duars; ad. ♂ ... | 4·6 | 2·6 | ·5 | ·8 | ·8½ | 18 | 8 × 6 | 6 × 8 |
| Sivok, Upper Bengal; ad. ♂ ... | 4·4 | 2·5 | ·4 | ·7 | ·7 | 19 | 9 × 6 | 6 × 7 |
| Haldibari, Cooch Behar; yg. ♂ ... | 4·2 | 2·3 | ·5 | ·7− | ·7 | 16 | 8½ × 6 | 7− × 8 |
| Golaghat, N. E. Assam; old ♂ ... | 4·6 | 2·8½ | ·5 | ·8½ | ·8 | 17 | ... | ... |
| Golaghat, N. E. Assam; yg. ad. ♂ | 4·1½ | ... | ·5 | ·6½ + | ·7 | 15½ | 9 × 7− | 6 × 8− |
| Sivok, Upper Bengal; ad. ♀ ... | 4·2 | 2·2 | ·5 | ·6½ | ·7 | 17 | 8 × 6 | 6 × 8 |
| ?Assam (*vicinus*. type) yg. ad. ♀... | 4·1½ | 2·2 | ·5 | ·7 | ·7− | 17 | 8½ × 6 | 6 × 7½ |

The first skull on this list belongs to the skin in Hodgson's collection, above referred to, which in pattern and colour is more like whitish examples of *bondar*. Apart from the bullae which are exceptionally long, it agrees tolerably closely with the biggest of the rest. The second skull, also Hodgson's, has no skin and like the first is doubtfully inserted here. The teeth are short, but it is peculiar in the extreme abbreviation of the obtusely angular postorbital processes which are only 22 mm. from point to point, clearly an abnormality.

In the rest the skulls and teeth closely resemble in size those of *hermaphroditus* and *laneus*. The skull of the old ♂ from Golaghat with a condylobasal length of 115 mm. has the sagittal crest 4½ mm. high and the postorbital processes 36 mm. from point to point, large and transversely directed as in the type of *laneus* and in the old skull of typical *hermaphroditus* from Bellary. The ♂ skull from Narbong, Darjiling, with a condylobasal length of 113 mm. is similar, with the sagital crest 5 mm. high but the postorbital processes only 30 mm. from point to point. The larger ♂ skull from Hasimara, with a condylobasal length of 118 mm. and the occipital suture just traceable also has the sagittal crest 5 mm. high, but the processes are defective. In the rather older ♂ skull from Sivok, with a condylobasal length of 111 mm., the crest is only 3 mm. high and the processes are thinner than in the Narbong skull and 31 mm. from point to point.

The skull of the adult ♀ from Sivok, with a condylobasal length of 109 mm., and the occipital suture obliterated, has no true sagittal crest, the temporal ridges being merely coalescent to form a median ridge with slightly undulating edges, 3 mm. wide, on the parietals. In the young adult type-skull of *vicinus*, with the basioccipital suture unclosed but the dentition complete and the median frontal suture obliterated, the temporal ridges are 2½ mm. apart on the frontals, 8 mm. on the parietals. In the young adult ♂ skull from Golaghat, shown to be younger by the unfused median frontal suture, but with complete dentition, the temporal ridges are 6 mm. apart on the frontals, 10 mm. on the parietals. This comparatively late development of the sagittal crest in ♀ *pallasii* may be contrasted with its average earlier development in the following race *ravus*.

(*To be continued*).

# FURTHER RECORDS OF INDO-CEYLONESE CHALCID FLIES.

BY

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Over fifteen years ago the senior author published an annotated list[1] of the then known chalcid flies of the Indo-Ceylonese region and two years later he issued another paper[2] on the parasitic hymenoptera of South India in which were included some more of the chalcid flies which were not recorded previously. Since then many more forms have been noted and it is the object of this paper to supplement the earlier lists with a record of the Indo-Ceylonese forms which have been noted and identified recently with brief notes as regards their hosts, locality, distribution etc., and with bibliographical references. As a continuation of the previous lists it is hoped that this paper may serve to bring our knowledge of the Indo-Ceylonese forms uptodate and in view of the economic importance of these minute wasps as natural enemies of some of our important crop-pests it may be of some help to agricultural entomologists who may be interested in the biological control of insect pests by means of various insect parasites. The thanks of the writers are due to Dr. Ferriere of the Imperial Institute of Entomology, London, to Prof. Timberlake, the famous Californian authority on Chalcids and to others who examined our specimens and helped us in getting them identified for us. It is also hoped that this list might prove of some use as a reference list to those interested in the study of this interesting group of parasites.

## SUPERFAMILY: CHALCIDOIDEA.

### Family: Agaonidae.

*Blastophaga* Grav.

Sub-genus: *Elizabethiella* Grandi.

*Blastophaga* (*Elizabethiella*) *gomberti*, Grandi, Bull. Soc. Zool. Fr. liii, p. 70 (1928), India.

*Ceratosolen* Mayr.

*Ceratosolen berlandi*, Grandi, Bull. Soc. Zool. Fr. liii, p. 74 (1928), India.

### Family: Chalcididae.

*Leucospis* Fabricius.

*Leucospis malabarensis*, Brues, Psyche, xxxii, p. 27 (1925), India.

*Euchalcidia* Masi.

*Euchalcidia crassicornis*, Masi, Bull. Ent. Bologna ii, p. 173 (1929), India.

*Dirhinus* Dalman.

*Dirhinus pachymerum*, Masi, Eos. iii, p. 42, India.

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[1] 'A Check List of Indo-Ceylonese Chalcid Flies' by T. V. Ramakrishna Ayyar, *Spolia Zeylanica,* vol. xiii, 1925.

[2] 'The Parasitic Hymenoptera of Economic Importance in South India' by T. V. Ramakrishna Ayyar, *Bulletin of Entomological Research*, vol. xviii, 1927.

*Brachymeria* Westw.

*Brachymeria nephantidis*, Gahan, Proc. U.S. Nat. Mus. No. 2831, Art. 77, p. 5 (1930), on Nephantis, India.

*Hockeria* Walk.

*Hockeria atra*, Masi, Boll. Lab. Ent. Bologna, ii, p. 180 (1929), India.

*Stenochalcis* Masi.

*Stenochalcis quadridentata*, Masi, Boll. Lab. Ent. Bologna, ii, p. 157 (1929), India.

FAMILY: EUCHARIDAE.

*Schizaspidia* Westw.

*Schizaspidia manipurensis*, Clausen, Proc. Ent. Soc. Wash., xxx, pp. 83, 85 (1928). Manipur State, Assam, India.

FAMILY: TORYMIDAE.

*Podagrion* Spinola.

*Podagrion pachymerum*, Walk. Ramaswamiah, Madras Agril. Dept. Year Book, pp. 55-57 (1922). An account is given about the oviposition.

FAMILY: ENCYRTIDAE.

*Erencyrtus* Mahdihassan.

*Erencyrtus dewitzii*, Mahdihassan, Jl. Sc. Assoc. Maharajah's College, Vijianagaram, i, p. 71 (1923). On lac. Mysore, India.

*Lissencyrtus* Cameron.

*Lissencyrtus somerville*, Mahdihassan, Jl. Sc. Assoc. Maharajah's College, Vijianagaram, i, p. 71 (1923). On lac. Mysore, India.

*Tachardiaephagus* Ashmead.

*Tachardiaephagus tachardiae* (How.) Ferriere, Bull. Ent. Res. xix, Pt. 2, p. 171 (October 1928). Synonymical notes given:

= *Encyrtus tachardiae*, Howard, 1896.
= *Tachardiaephagus thoracicus*, Ashmead, 1904.
= *Lissencyrtus troupi*, Cameron, 1913.

According to Dr. Ferriere the species *somerville* should be included in this genus and the same can be distinguished from *T. tachardiae* (How.) 'especially by the colour of the head, which is orange yellow like the thorax, instead of dark'. Insects noted on lac, on *Zizyphus jujuba;* Bengal, India.

*Encyrtus* Latreille.

*Encyrtus barbatus*, Timb., on *Lecanium nigrum,* Coimbatore, India.

*Microterys* Thoms.

*Microterys kotinskyi*, Full. on *Lecanium nigrum*, Coimbatore, India.

*Tetracnemus* Westw.

*Tetracnemus indicus,* Ramakrishna, Rec. Ind. Mus. xxxiv, Pt. iii, pp. 287-288 (September 1932). Parasites of an injurious mealy bug *Pseudococcus citri* commonly noted on Agathi—*Sesbania aculeata* in Coimbatore, India.

*Homalotylus* Mayr.

*Homalotylus flaminus* (Dalm.). On *Coccinellid*, Coimbatore, India.

### FAMILY: PTEROMALIDAE.

#### *Trigonogastra* Ashmead.

*Trigonogastra brunneicornis*, Ferriere, Bull. Ent. Res. xxi, Pt. 3, pp. 356-357 (October 1930). Species described. On Pupa of *Agromyza* sp. mining stems of *Hibiscus esculentus*. This species differs from *T. rugosa* and *T. megacephala* 'by the large size, the darker green coloration of head and thorax, the presence of four teeth on both mandibles and the more elongated funicle joints.' Peradeniya, Ceylon.

#### *Acroclisoides* Girault.

*Acroclisoides indicus*, Ferriere, Bull. Ent. Res. xxii, Pt. 2, pp. 279-280 (June 1931). Species described. 'Genus is well characterized by its large head, which is much broader than the thorax and broader than long when seen in front, by the elongate antennae with two ring-joints, the thickened marginal vein, the very short petiole, and the small triangular abdomen.' Also key to species of the genus given. On eggs of a Pentatomid bug on teak leaf. Dehra Dun, U.P., India.

#### *Agiommatus* Crawford.

*Agiommatus acherontiae*, Ferriere, Bull. Ent. Res. xxii, Pt. 2, pp. 280-281 (June 1931). Species described. Key for distinguishing the three species of the genus given. On eggs of *Acherontia styx*, Westw. Dehra Dun, U.P.

### FAMILY: PERILAMPIDAE.

#### *Perilampus* Latr.

*Perilampus microgastris*, Ferriere, Bull. Ent. Res. xxi, Pt. 3, pp. 353-354 (October 1930). Species described. A hyper-parasite on *Microgaster indicus*, Wilkn., *Apanteles machaeralis*, Wilkn., and a Braconid parasite of *Nephantis serinopa*, Meyr., Hosangabad, C.P., and Dehra Dun, U.P., India.

### FAMILY: ELASMIDAE.

#### *Elasmus* Westw.

*Elasmus brevicornis*, Gahan, Treubia iii, p. 50 (1922): Type locality Java, Buitenzorg: Host—*Erionata thrax*, L.; Ferriere, Bull. Ent. Res. xx, Pt. 4, p. 413 (December 1929). Parasitic on larva of *Hapalia machaeralis*, Wlk., on *Tectona grandis*, Dehra Dun, India, also noted in Kuala Lumpur, Malaya, from *Psalis stultalis* on *Pogostemom patchouli*, and also found parasitic on larva of *Sylepta derogata*.

*Elasmus ceylonicus*, Ferriere, Bull. Ent. Res. xx, Pt. 4, p. 418 (December 1929). Species described. From cases of *Psyche albipes*—the Tea Bagworm, Pelmadulla, Ceylon.

*Elasmus homonae*, Ferriere, Bull. Ent. Res. xx, Pt. 4, pp. 415-416 (December 1929). Species described. From *Homona coffearia*, Nietn., on tea, Ceylon. Points that distinguish this species from *E. nephantidis*, Roh., are also given.

*Elasmus hutsoni*, Ferriere, Bull. Ent. Res. xx, Pt. 4, p. 412 (December 1929). Species described. Bred from cases of the Tea Bagworm *Psyche albipes*, Mo., Pelmadulla, Ceylon.

*Elasmus hyblaea*, Ferriere, Bull. Ent. Res. xx, Pt. 4, p. 414 (December 1929). Species described. Parasitic on second instar of *Hyblaea puera* larva, Aravallica, Nilambur, Madras.

*Elasmus johnstoni*, Ferriere, Bull. Ent. Res. xx, Pt. 3, pp. 258-259 (October 1929). Species described. Karnal, Punjab, India. Bred from *Platyedra gossypiella* and *Earias spp.*

'This species may be distinguished by the dark colouration of its body and legs, by the hind tibiae being clear with a brown ring below the middle and by the form of antennae and abdomen.'

*Elasmus claripennis*, Cameron. Ferriere, Bull. Ent. Res. xx, Pt. 4, p. 418 (December 1929). Synonyms given:

= *Cyclopleura claripennis*, Cameron, Ind. For. Rec. iv, p. 92 (1913).

= *Elasmus colemani*, Mahdihassan, Jl. Sc. Assoc. Maharajah's College, Vijianagaram, i, p. 69 (1923) as parasitic on *Eublemma amabilis*, M.; bred with *Tachardia lacca* from *Eublemma amabilis* predaceous on the former, India, Dehra Dun and from Bengal; Ferriere, Bull. Ent. Res. xix, Pt. 2, pp. 171-172 (October 1928). Species described. The relationship of the genus *Cyclopleura* with *Elasmus* given and the synonyms discussed. The distinguishing features that characterise *E. claripennis, E. indicus*, Roh., and *E. nephantidis* Roh., are also given.

### FAMILY: EULOPHIDAE

#### *Pleurotropis* Forster.

*Pleurotropis detrimentosus,* Gahan, Proc. U.S. Nat. Mus. No. 2831, Art. 77, p. 9 (1930). India.

#### *Thripoctenus* Craw.

*Thripoctenus maculatus*, Waterston, Ann. Mag. Nat. Hist. v (10), pp. 243-244 (1930). Species described. Punjab, India. An internal parasite of the Vine thrips (*Rhipiphorothrips cruentatus,* H.).

#### *Coccophagus* Westw.

*Coccophagus tschirchii,* Mahdihassan, Jl. Sc. Assoc. Maharajah's College, Vijianagaram, i, p. 82 (1923). Reared from the Mysore lac insect; Ferriere, Bull. Ent. Res. xix, Pt. 2, pp. 173-174 (October 1928). Fully described; Compare, Proc. U.S. Nat. Mus. vol. lxxviii, Art. 7, p. 41 (1931). Redescribed from specimens from Bengal, Kundari, 1927, on Lac insect on *Butea frondosa.*

#### *Tetrastichus* Haliday.

*Tetrastichus gardeneri,* Ferriere, Bull. Ent. Res. xxii, Pt. 2, pp. 291-292 (June 1931). Species described: from eggs of Pentatomidae on teak; from the same eggs were also bred *Acroclisoides indicus*, and an *Eupelmid* identified as *Anastatus colemani,* Craw.; notes on Tetrastichus species given as regards their parasitic habits, Dehra Dun, India.

*Tetrastichus schoenobii,* Ferriere, Bull. Ent. Res. xxii, Pt. 2, pp. 290-291 (June 1931). Described: Malaya Peninsula, Ceylon and Siam on eggs of *Schoenobius bipunctifer* (Malaya and Siam) and of *Spodoptera mauritia* in Ceylon; also noted on eggs of Schoenobius in South India.

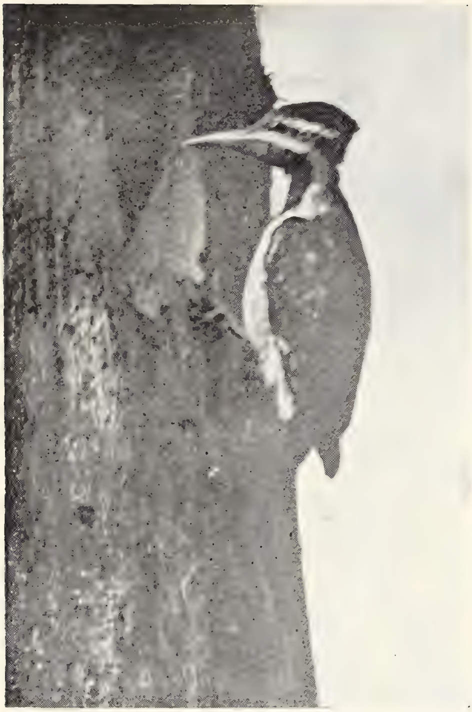
#### Sub-genus: *Geniocerus* Ratz.

*Tetrastichus* (*Geniocerus*) *purpureus* (Cam.). Ferriere, Bull. Ent. Res. xix, Pt. 2, pp. 174-175 (October 1928). Synonyms given: Reared from Lac on *Zizyphus jujuba*, Bengal. Its relationship with the synonyms given and also the distinguishing features of the sub-genus *Geniocerus*, Ratz.

#### *Trichospilus* Ferriere.

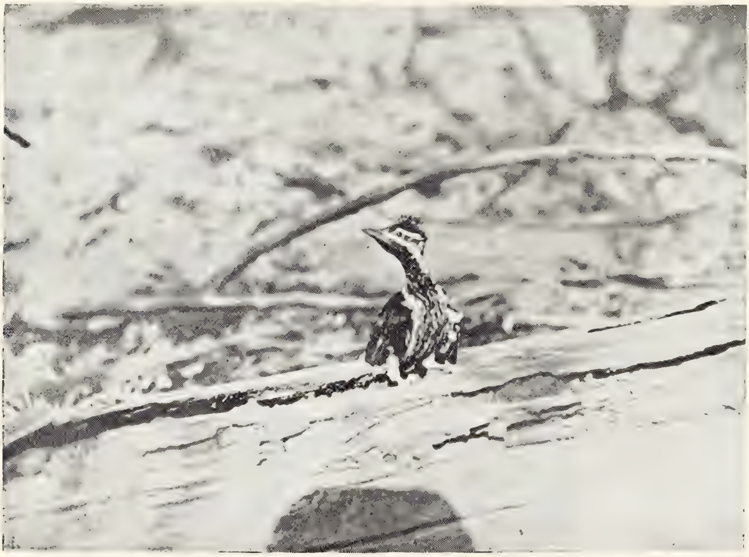
*Trichospilus pupivora*, Ferriere, Bull. Ent. Res. xxi, Pt. 3, pp. 358-359 (October 1930). Species described. On *Nephantis serinopa,* Meyr. Coimbatore, India; Peradeniya, Ceylon etc.

*Note.*—'By an oversight the record of the species *Trichogramma minutum*, R. (TRICHOGRAMMATIDAE) was left out in the text. It has been noted in India on the eggs of the sugarcane borers (*Diatroea, Argyria* and *Scirpophaga* spp.), the paddy stem borer (*Schoenobius incertellus,* W.) and the stored paddy moth (*Sitotroga cerealella*, Ol.). During recent years this wasp assumed very great importance as an important parasite and a good deal of literature has accumulated in connection with its utility as a natural enemy of borers on cane.'—(T.V.R. & V.M.)



1. Southern Golden-backed Woodpecker at nest.[1]

2. Nest holes of Malherbe's Golden-backed Woodpecker.



3. Young Southern Golden-backed Woodpecker.

[1] This nest entrance was originally quite round but has been enlarged with a knife to secure the eggs.

# SOUTH INDIAN WOODPECKERS.

BY

F. N. BETTS.

The heavily wooded slopes of the Nilgiris and other ranges of the Western Ghats provide an ideal habitat for the Woodpeckers, a family which is richly represented in Southern India. Even the most casual observer cannot help being struck by their abundance and variety, for their brilliant plumage and loud voices make them among the most conspicuous of the avifauna of the hill jungles.

The woodpeckers furnish an interesting study in evolution and an excellent example of how under favourable conditions, a particular form of life will tend to develop on widely divergent lines. The most striking instance of this phenomenon is the unique fauna of Australia, where the primitive marsupial mammals which have been ousted by more efficient rivals throughout the rest of the world, have, through the isolating action of a sea barrier, been freed from competition and enabled to evolve types as different as the kangaroos and the marsupial wolf, the Tasmanian devil and the pouched mole. In a similar way on a small scale, the Woodpeckers, having tapped a source of food supply unavailable to other birds, have thrown up a great variety of species all more or less highly specialised for their line of life. In their case, however, the process is in a much earlier stage and there are living genera showing every grade from comparative primitiveness up to a very high degree of specialisation. So far progress has been all on one particular line but it seems as if the limit has been reached in that direction and that various species are now beginning to evolve along different paths.

The two greatest controlling factors in bird life are the food supply and the problem of safeguarding their young whilst they are in the helpless stage. The woodpeckers have solved both questions very successfully by developing themselves into living pick-axes. The ordinary insectivorous birds can only obtain their food on the leaves and outer surfaces of the boughs and trunks of trees and are quite unable to get at the rich stores of invertebrate life lurking under the bark or boring into the wood and the woodpeckers have a free field. Again in the matter of breeding sites, birds which nest in holes have many advantages and are far less exposed to the elements and their enemies than those which build open nests in trees or lay their eggs upon the ground. Many species of almost every order of the avian class have adopted the hole-breeding habit and probably more would have done so had it not been for the comparative scarcity of suitable natural hollows. One has only to think of the extraordinary sites often chosen by Tits to realise the straits to which some birds may be put. The Parrots, Nuthatches and others have got as far as enlarging or adapting ready-made holes but it is only the Woodpeckers and their cousins the Barbets who have solved the problem and made themselves independent of nature by learning to tunnel in wood. There are of course many other birds which excavate holes in the ground but that is another story. As a matter of fact, the majority of the smaller and medium sized birds which nest in holes in trees are parasitic on the Woodpeckers in so far as the disused 'dug-outs' of the latter are eagerly adopted as breeding sites and the rightful owner may even be evicted whilst still in occupation in certain cases.

Though the family by specialising have been so successful in exploiting their particular environment, it must be remembered that this is a strictly limited one. The typical Woodpecker can only exist in well wooded regions and even in such a considerable area is necessary to support each bird. Thus we find a keen and ever increasing competition among the various members of the family forcing some species to diverge from the main type to begin to seek a livelihood along different lines. As the pressure in the more congenial environment increases they are forced to adapt themselves to less agreeable conditions until we find them colonising areas so apparently unsuitable as the Arizona desert or the treeless Pampas of South America.

The region covered in this paper is a particularly suitable one for the study of the evolution of the Woodpeckers. For among the twelve species that occur are types representative of every phase in the history of the family. Before going further it would be as well to give some account of them.

1. **The Little Sealy-bellied Green Woodpecker,** *Picus vittatus myrmecophaneus* (Stresemann) appears to be an uncommon species. Davison says a few pairs are resident in the sholas round Ootacamund and the only two I have seen were on the borders of copses on the downs of the Nilgiri plateau. It seems to feed mainly on ground dwelling ants like its English congener *Picus viridis* and is consequently partial to park land and open country.

2. **The Southern Yellow-naped Woodpecker,** *Picus chlorolaphus chlorigaster* Jerdon is very widely spread throughout the forested regions of South India and wanders up to 5,000 ft. but is not common above about 3,500 ft. Rather a shy, solitary species it is only to be found in heavily wooded country being particularly fond of dark, marshy ravines clad in evergreen forest or the borders of jungle streams, where it hunts over rotting fallen trees. The nest is excavated usually quite low down in a rotten stump in heavy jungle. The entrance is a neat round hole seemingly very small for the bird and on two occasions I have found them made just below where a large flat fungus jutted out from the tree like a half plate and almost concealed the nest. After the breeding season small family parties are to be seen but they do not hang together for long. They are silent birds, their only note being an occasional loud sharp 'tchak'.

3. **The Southern Yellow-fronted Woodpecker,** *Leiopicus mahrattensis mahrattensis* (Lath.) is a low country species which seldom ventures far into the hills and only into the drier areas such as the northern slopes of the Nilgiris round Masinagudi where the jungle is of a light dry zone type mostly teak, scrub and bamboo,

4. **The Southern Indian Pigmy Woodpecker,** *Yungipicus hardwickii hardwickii* (Jerdon) is widely spread and much commoner than one suspects as owing to its size and habits it is very inconspicuous. Entirely arboreal it keeps to the topmost branches of high trees where it is extremely active in running over the boughs and is constantly on the wing as it flits from one twig to another. Pairs and single birds are the rule though they very frequently go about in company with the large mixed flocks of insectivorous birds which are such a feature of the monsoon. They are more like Nuthatches in their ways than Woodpeckers though they cannot run head downwards as the former do. In their flight too, they lack the bounding action so characteristic of the family. Parklands and open woodlands are their favourite haunts and they will ascend as high as 4,500 ft. in suitable country though commoner at lower elevations. Like all our Woodpeckers they are very early breeders, having young by the end of February. The nest-hole is usually excavated very high up in a small dead bough of a tree standing more or less in the open. This is the only Woodpecker which I have seen with food in its bill when visiting the nest, the usual habit being to regurgitate from the crop. In this case, the male used to fly up with a beakful of insects uttering his little trilling call, on hearing which the female who was in the nest would poke her head out to receive the prey.

5. **The Southern Rufous Woodpecker,** *Micropternus brachyurus gularis* (Jerdon) is a rather scarce species but well distributed in forest country up to about 4,000 ft. They are silent and solitary birds. Their food seems to consist almost exclusively of ants both terrestrial and arboreal. Their breeding habits are remarkable for the breeding cavity is always excavated in a nest of the arboreal *Cremastogaster* ants, which build those black football-shaped papier-mâché-looking affairs so common in the jungle trees. I have never had the luck to find one but many observers state that the Woodpeckers choose occupied colonies and that the ants remain in possession throughout the period of incubation though doubtless they are mostly devoured by the birds before very long. Davison remarks that he has found small naked young of this species in a nest still swarming with ants which is extraordinary when one considers that these insects are among the greatest menaces to which the helpless nestlings of most birds are subject.

6. **The Southern Golden-backed Woodpecker,** *Brachypternus benghalensis puncticollis* (Malherbe) is quite the commonest Woodpecker below 4,000 ft., occurring numerously almost everywhere trees are to be found. Above that level its place is taken by Malherbe's Golden-backed Woodpecker (*q. v. infra*) which is definitely a hill species. In the Nilgiris it does not seem to wander much above the plains level but in Coorg at any rate it is extremely common at 3,500 ft. and there is a zone in which both species occur. On the whole *B. benghalensis* prefers the drier and lower regions and *Chrysocolaptes guttacristatus* the higher and wetter. The Golden-backed Woodpecker is a very noisy bird and decidedly sociable. The family parties hang together until the following breeding season and in the monsoon they are always to be found

in the large mixed flocks which gather at that time of year. They are mainly arboreal in their habits but come to the ground on occasion. Their staple food is ants of various sorts but they will take any insects they find. On one or two occasions an odd fruit or two has been taken from the stomachs of specimens but this was probably accidentally swallowed. I have on two occasions seen one drinking honey, once from the blossoms of an *Acrocarpus* and once from a *Grevillea.* The bird looked most out of place clambering awkwardly among the sprays. They are mainly arboreal but come to the ground occasionally. Like all our Woodpeckers, this species is an early breeder and the two or three eggs are usually laid by the end of February. The nest-hole with its neat round entrance is excavated in dead trees at any height but most commonly from 10-20 ft. up. The sitting bird is very wary poking her head out at the first sound of approaching footsteps though she will often delay taking flight until one is quite near, thus betraying the presence of an otherwise unsuspected nest.

7. **The Golden-backed Three-toed Woodpecker,** *Dinopicus javanensis rubropygialis* (Malherbe) is another common species inhabiting much the same range as the last. Superficially the three Golden-backed Woodpeckers are extraordinarily similar. In the hand, of course, they can be distinguished without difficulty but in the field this is by no means the case. Size is little criterion unless one has a standard of comparison and the easiest points to look for are the colours of the hindneck, which is white in *C. guttacristatus* and black in the other two species, and the rump and lower back which in the case of *B. benghalensis* is black but crimson in the other two. In general habits the present species closely resembles the last but its call is quite distinct being a rather weak, tinny scream. The breeding season is in January and February and it seems to choose extremely rotten trees in which to excavate its nest. I have found one or two dug in such decayed wood that it was possible to enlarge the hole with no tools other than the fingers.

8. **Malherbe's Golden-backed Woodpecker,** *Chrysocolaptes guttacristatus delesserti* (Malherbe) as before mentioned is a hill species and the only Woodpecker at all common on the plateau and higher slopes of the Nilgiris. In Coorg it is found from the tops of the highest hills at 5,000 ft. and more, down to below 3,000 ft. It is more of a forest bird than *Brachypternus benghalensis* and while by no means shy or averse to the neighbourhood of mankind, it is very much at home in the interior of the heavy evergreen woods which clothe the hillsides in the wetter areas where it hunts among the great tree trunks, seldom coming near the ground. Except in the breeding season small family parties are the rule but they are select and do not mingle with other species. They are excessively noisy especially when alarmed their cry being a discordant trilling scream. The breeding season seems to be very early even for this family. I have found eggs by the middle of December. A favourite tree will be used year after year, a fresh hole being excavated each time until the trunk is so riddled with borings that it collapses. A distinctive characteristic of the species

is that the entrance to the hole which is very large for the size of the bird is practically never neatly circular as in the case of most Woodpeckers, but is a rather irregular oval deeper than it is wide. In one case I found it took a full month to excavate the cavity.

9. **The Black-Backed Woodpecker,** *Chrysocolaptes festivus* (Bodd.) is rare in South India and there are but few records of its occurrence. Hume obtained specimens and Howard Campbell a nest at the northern foot of the Nilgiris.

10. **The Malabar Heart-spotted Woodpecker,** *Hemicircus canente cordatus* Jerdon though nowhere numerous is to be found over most of the wooded hilly country of South India, wandering as high as 4,500 ft. on the Nilgiris. They are most comic little birds having all the family mannerisms exaggerated to an absurd degree. Their flight is weak and excessively undulating. The tail is extremely short and this is very apparent when on the wing and gives them the appearance of having met with an accident. When running up a bough, they move in short, sharp jerks accompanied by convulsive bobs and bows so that they look more like clock-work toys than living creatures. They are solitary birds and great wanderers seldom remaining long in any one locality. They rather shun cultivated land but otherwise their tastes are catholic and they may be found anywhere there is a good growth of timber. They are entirely arboreal and hunt very largely among the thin terminal twigs where they as often perch across a branch, albeit somewhat awkwardly, as in the normal Picine manner. The call is a very characteristic and rather pleasant 'twee, twee, twee' which is sometimes extended into a trill of seven or eight notes. There seems to be little known of the breeding habits of this bird. I have not so far been fortunate enough to find a nest but both in the Nilgiris and in Coorg the birds are paired in January and February and it is probable that they breed then in common with most of the members of the family.

11. **The Malabar Great Black Woodpecker,** *Thiroponax javanensis hodgsonii* (Jerdon) is typically a bird of the heaviest evergreen forests of the Western Ghats where it occurs fairly commonly up to 4,000 ft. In Coorg I have seen it in the drier and more open teak and bamboo jungle of the Mysore border but it is only a wanderer there. Shy and wary, they keep to the interior of the forests and only occasionally venture into cultivation on the jungle edge. Such large birds need a wide range so that the numbers in any one locality are never great. They seem to work a considerable area with some regularity for a family of three or four used to appear in the neighbourhood of my bungalow in the Nilgiris for a few days every six weeks or so for months on end. They would be seen for a couple of days and then disappear until their next visit fell due. Except in the breeding season small parties keep together. They are very noisy and the single, wild clanging note is audible at a great distance. As they take wing this call is often expanded into a ringing laugh. They seem to be exclusively arboreal and frequent the largest and tallest trees, hunting over the trunks and main boughs seldom venturing out among the smaller branches.

12. **The Nilgiri Piculet,** *Picumnus innominatus avunculorum* Hartert is a rare species only reported from Travancore, Wynaad and the Nilgiris. I have only seen it on two occasions, both on the Nilgiri slopes at about 4,500 feet among scrubby trees on the border of open grassland. In habits they were more like Nuthatches than Woodpeckers being very active in running up and down among the thin outer branches, frequently perching across them and taking wing to pass from one to another. They were silent little birds very much preoccupied in their affairs and very tame or rather quite indifferent to the presence of man. Their flight was strong and direct with but little of the usual Woodpecker bounds.

It seems probable that the original Woodpecker stock came from small birds with normal tails and comparatively small though powerful bills which obtained their food much as the Nuthatch does by searching the branches of trees for the small insects concealed in the bark and which bred in natural holes, but gradually learned to enlarge and adapt them for their purposes. The Piculets even at the present time, have hardly advanced beyond this stage as their tail feathers are still soft and weak and the bill fairly short and conical. While they do on occasion excavate a complete hole, they nearly always breed in bamboos which only entails making an entrance into the ready-made hollow interior. Once started on this line of advance, specialisation proceeded apace; the tail feathers stiffened to act as a support and a fulcrum, the bill became flattened and lengthened until it formed a most efficient chisel while the tongue grew long and sticky to aid in the withdrawal of grubs from their galleries in the tree trunks. Size also increased until the typical Woodpeckers reached their acme in species such as the Great Black Woodpecker and the Slaty Woodpecker of Burma and Assam. It would seem that the latter represent about the size limit for birds of their particular habits, as these giants of the race are seldom numerous, and require a very large territory to provide them with a sufficiency of food, besides being necessarily restricted to the densest and biggest forest country.

With increasing size the typical Woodpeckers become more and more dependent on wood-boring grubs as food though ants are always a great stand-by with all the members of the family. The larger species are prevented by their size from working the smaller leafy branches and outermost twigs, the regions richest in insect-life, while ants and such small fry unless available in great quantity do not make nearly so satisfying a meal as a few large juicy grubs. Accordingly, it is in the largest forms that the greatest development of the bill is found. In the smallest birds, like *Yungipicus hardwickii* and *Hemicircus canente*, the bill is sharply pointed and fairly short. In the medium genera such as *Leiopicus* and *Dinopicus* it is still pointed but comparatively much longer and stronger. In the largest of all such as *Thriponax* and *Chrysocolaptes* it terminates in a flat chisel edge, a much more efficient tool than a mere point.

While the majority of our Woodpeckers conform to type in their habits there are at least two genera which show a well-marked divergence from the main path. The Green Woodpeckers, for instance, as typified by *Picus vittatus* are apparently gradually turning into ground feeders. Whilst still true Woodpeckers in all respects they obtain a great deal of their food by preying on terrestrial ants' nests and have left the heavier forests for lighter and more open woodlands, venturing right out into treeless country in search of their favourite rations. In our local species this trait is only in its early stages but it is carried much further in other countries such as the Argentine where trees are scarce.

The Rufous Woodpecker has followed a different line of development to the extent of becoming almost a parasite on the arboreal *Cremastogaster* ants. It is not a very common species but as far as my personal observation goes, it lives almost entirely on these ants, seldom, if ever boring for grubs though it occasionally comes to the ground and has been seen by Legge breaking up dried cowdung in search of the maggots and beetles below. The sticky acrid substance which is nearly always found smeared over the head and breast of birds of this species is said to be derived from the ants' nests into which it burrows, but there seems a possibility that it might be a secretion of the bird itself, developed as a defence against the enraged insects whose homes it attacks and uses for breeding purposes.

Before closing this paper I must allude to the curious habit of drumming indulged in by many if not all Woodpeckers. There has been a lot of discussion lately in the *Field* and other papers as to whether this sound is produced purely mechanically or whether it may be vocal. I have watched birds in the act at close quarters on several occasions and as far as I could detect the former is the correct view. A particular and presumably specially resonant dead branch is chosen and the bird proceeds to tap it with the bill lightly and so rapidly that the movements of the head are barely visible giving an effect much like the roll of a drum. After every few seconds the bird pauses and looks round expectantly as though awaiting an answer or the arrival of its mate. The same branch is resorted to time after time and will be found to be almost unmarked, the whole action being very different from the slow, heavy strokes employed when a nest is being excavated or grubs dug out. While apparently a mating call in its origin, drumming may be heard throughout the year. The species which I have seen in the act are *Chrysocolaptes guttacristatus*, *Brachypternus benghalensis*, *Micropternus brachurus* and *Yungipicus hardwickii.*

# REVIEWS.

I. A GAME BOOK FOR BURMA AND ADJOINING TERRITORIES, by E. H. Peacock, Deputy Conservator of Forests and Game Warden, Burma (Retired), 292 pages, with xxvi plates, sketches, and a map. H. F. & G., Witherby, London, 1933, price, 12/6.

The best way to commence this Review appears to be by quoting from the Foreword by Mr. C. W. Hobley: 'A Book of the character provided by Mr. Peacock was badly needed, . . . His main difficulty has been one of compression. Visitors to Burma, whether for sport or for nature study, will find this book a mine of information, all well arranged.'

Those who have visited Burma in recent years—as did the present writer—have indeed felt the need of such a book as this. To follow this work there is need for an Angler's Book for Burma, on the lines of *The Rod in India* by H. S. Thomas, for the country in its hilly regions is an Angler's Paradise.

The author accurately describes Burma as hard to equal from the point of view of a sportsman with naturalistic tendencies; and it is to be hoped that this book will attract visiting sportsmen of the right type the presence of whom in the forests is a check on poachers, and their methods an example to the people of the country.

It is sad to read that the Javan Rhinoceros—the Lesser One-horned Rhinoceros (*R. sondaicus*) is almost certainly doomed to extinction in Burma; and that its smaller relative, the Asiatic Two-horned Rhinoceros (*R. sumatrensis*), is much restricted in habitat and also in danger of extermination.

The appointment of a Provisional Game Warden for Burma was attended by many good results; and it is urged (with small hope of success) by all who know the subject well that in most Provinces in India there should be a Wild Life Department. Game and Wild Life Associations do much good, but only by means of a Government Department can protective measures be coordinated and have the desired results. That the post of Game Warden in Burma has been abolished is very much to be regretted.

Reading of 'Plans and Preliminaries' the intending sportsman will find all the information he requires. One thing only is omitted—the best method of keeping off leeches! The writer can say that woollen stockings, over which cotton stockings, and a high felt spat damped with kerosine, will afford immunity from leech bites even if it be necessary to wade through water.

Those with experience will concur with the author's choice of rifles (p. 40); but few will agree that a return to the 8 and 12 gauge black powder rifles of their early days can be viewed with equanimity. The ·577 black power magnum rifle, however, has scarcely been surpassed in practical efficiency by any of the modern H. V. weapons.

Writing of cameras and photography the author gives much practical advice, the result of experience—the reading of which would have saved many, this writer for one—much avoidable expense. The results obtained by the author are not equal to the expert illustrations in some recent books; but as he says, his are the first to appear in a book of wild life in Burma: and they are much in advance of what most amateurs have achieved.

In Tracking and Still-Hunting, the reader travels with a skilled sportsman; and in '*Preservation and Care of Trophies*' he receives much sound advice. Three pounds of the burnt alum and saltpetre mixture is a short allowance for a tiger skin: double that quantity is nearer the mark: and it should be noted that the alum and saltpetre ought to be kept in separate tins until required for use. The writer has found that, unless the circumstances be exceptional, it is not necessary to stretch a skin on the ground, or on a frame, as the skin, if spread out on the ground in symmetrical proportions, will retain that shape within fifteen minutes of the application of the preservative powder. It can then be left on the ground, or raised for airing and drying in any manner found necessary. Unburnt alum and common salt is also efficacious, and can be used in proportions varying with the humidity of the atmosphere.

Of the elephant, Mr. Peacock writes with intimate knowledge. It is interesting to learn that sharp tusks are the result of constant rubbing and sharpening He remarks at page 89 as to measures found entirely successful in dealing with crop-raiding elephants. These could be usefully followed in parts of Southern India, and in Ceylon.

Of the bison also there is everything that a sportsman can wish to know. There is no finer sport than the tracking up of a solitary bull bison and what the author writes of this and the similar pursuit of elephant and *Tsaine* should certainly attract sportsmen to a delightful country. The photographs give excellent impressions of these animals. The intending sportsman is, very properly, carefully warned to avoid shooting immature bulls or cows of bison and *Tsaine*. It may be added that sportsmen without experience should try and arrange a visit to the Pidaung Sanctuary to there see bison and *Tsaine* of all ages and learn to distinguish them.

One would not go to Burma for buffalo, the heads obtainable in India being larger and without suspicion of the animal having run wild. Anyone desirous of adding the horns of a thamin stag to his collection, or even of seeing these beautiful deer in the wild state, should pay a speedy visit to Burma, for this species is fast disappearing from the country. When the writer was in Burma over forty-two years ago thamin were exceedingly common in all suitable localities, and even now some few of the thousands of former days may be seen near Shwebo; but their time is not long. As the author says, thamin shooting in forest reserves should be entirely prohibited, and sanctuaries established to preserve them from extinction. So also with hog deer.

There are chapters on the Malayan sambur and on barking deer. Of the former the opinion is given that these are quite the hardest deer to photograph on foot. And attention is drawn to the peculiar bare hairless patch to be found on the throat of every wild sambur in Burma, the cause being probably a parasite peculiar to Burmese forests. Here is something for one of the 'ologists' to identify and explain.

Of other animals, Serow and Goral,—good photographs of these,—takin, wild pig, tapir, jackal, wild dog, mouse deer, are dealt with. Then there are chapters on the Himalayan black bear, the Malay bear, and the clouded leopard. Judging by the measurements and weight given, the Himalayan black bear of Burma is a smaller animal than the inhabitant of the Himalayas of India, where a large male will weigh as much as 380 lbs. and measure over 6 ft.

The author remarks that he has never known panther or tiger baits to be found or killed by wild dogs. In India such incidents are within the experience of a number of sportsmen.

The chapter on the tiger contains much of interest. The weight of a full grown tiger is underestimated at 400 lbs. and that of a tigress overstated as 300 lbs. The latter would be an extra large beast and 420 to 450 is the weight of the majority of tigers. The author truly remarks that in their writings many sportsmen of Indian experience have merely repeated observations of others without offering facts within their own observation. An instance is the common statement that tigers do not eat carrion, or the kills of other animals. This, as the author remarks, is far from the case. It is only by written notes taken on the spot that one can declare positively as to such things as the method of a tiger in killing, the extent of his appetite, whether it is the tiger or tigress which discards the tail of a kill or devours it, the direction of the wind in connection with sense of smell, and other matters requring elucidation.

'Tigers do not attempt to cover their kills with leaves and grass in the manner of a panther'. That may be so in the dense forests of Burma, but tigers in India often cover kills in this way. 'In Burma tigers almost invariably break the hind legs of large buffaloes and bullocks before attempting to kill them, . . .' In this also tigers of India differ, for the breaking of the hind legs of animals is most uncommon. The author is of course quite right in stating that tigers do not kill animals in a uniform manner. He is likely to be alone in his statement that the 'tit' of the tiger is in imitation of the sambur alarm call. He remarks, however, that the question remains an open one.

Those who have done much sitting over kills at night know that tigers make many different sounds. One that is not noticed is that very cat-like call made by a wounded tiger or tigress when on the point of dissolution. The experience of the writer is that tigers are not so silent in their ways as the author remarks.

Two pages of very interesting matter are given to the subject of the power of scent of the tiger. Mr. Peacock's views are moderate. Various writers proceed to one or other extreme on the subject. The late Mr. Abel Chapman wrote that a lion will accurately locate the position of an intended victim at a good half mile. He was of opinion also that wild fowl, teal especially, are keenly alive to the faintest clue from scent: a statement not borne out by the test of experience. Mr. Dunbar Brander writes that the tiger has hardly any sense of smell. The tiger has no doubt more sense of smell than many will credit him with. A large series of accurate observations, made with a testing of the wind on each occasion, is necessary to support positive assertions on the matter.

It is remarked that the sense of smell of a panther is more highly developed than that of a tiger. Perhaps the many occasions on which the writer has shot panther from a hide on the ground are no evidence of want of power of scent on the part of the panther, but due to his familiarity with the habitations of man and the smell of the human being.

Has anyone ever known a case in India of an animal being fed upon by a tiger when alive? That, surely, must be peculiar to the tiger of Burma.

As to 'sitting up' *versus* 'beating' Mr. Peacock has a good deal to say. One sportsman has remarked to the writer as to sitting up over a kill that one might as well set a spring gun, or press a button at one's tent door! The same sportsman would shoot a tiger from his perch in a beat when he had done nothing towards the rounding up of the tiger except sitting in the place he was told. The fact is that to arrive at such a pitch of perfection in one's knowledge of the habits of a tiger in respect to his kill, as will enable the sportsman to be confident of the return of the animal on the greater majority of occasions, is attained by few; for much experience in the methods leading to success is necessary.

In countries like Burma, where beating is almost impossible, sitting up is the only method; and the use of the electric torch is justified for several reasons if the tiger is to be fired at after dark: but it is true that this form of shikar engenders a distaste born of the secure success obtained by experience in such methods for: 'The sweets of destruction are somewhat tame, when no personal risks befall'. In any case the days are not far off when—in many parts of India at any rate—the shooting of tiger by night will have to be barred, as it has been for a number of years in the United Provinces.

As to photography, the invention of a noiseless flashlight bulb eliminates the objection to the very disturbing influence to game of cameras set at salt licks and water holes.

The author has never known his tiger or panther baits to be molested by wild dogs. In India such incidents are within the experience of a number of sportsmen.

Part III of the book is devoted to small game, and the information as to species and their habits etc. is useful and well tabulated. To an ear accustomed to the call of the Indian peafowl the call of the Burmese bird seemed markedly different. No writer on birds appears to have remarked this.

Miscellaneous mammals, birds, and reptiles, are dealt with in Part IV. The list is a long one. It does not seem safe in these days of the indiscriminate possession of firearms by all and sundry to say that any form of wild life is undeserving of protective legislation. In Ceylon the gunner slays anything that will go into the cooking pot, so the slaughter done by 70,000 license holders is immense; probably the 20,000 Burmese license holders are not backward as to destruction of the same description.

Part V notices the waters of Burma as teeming with fish, and the immense quantities of fish that are trapped annually as they pass to and from their spawning grounds. Many rivers in India have been almost depleted of fish by the merciless killing of everything that swims in their upper waters and tributary streams; and from what was observed by the writer in respect to the tributary streams of the upper Irrawady it is necessary that steps should be taken to prevent similar destruction in the rivers of Burma.

Mr. Peacock is much to be congratulated upon his most useful and well arranged book.

It is noticed that in the Map of Burma the railway lines from Thazi Junction to the Shan States on the East, and to Myingyan on the West, have been omitted. And it would have been as well for the several Game Sanctuaries mentioned in the book to have been indicated on the map.

R. W. B.

II. NIDIFICATION OF BIRDS OF THE INDIAN EMPIRE by E. C. Stuart Baker, C.I.E., O.B.E., F.Z.S., etc. Vol. II. *TURDIDAE-STURNIDAE.* Taylor & Francis, London, May 31, 1933. Price, 30/-.

The present volume deals with the whole of the birds included in vol. ii of the *Fauna*, with the exception of the *Cinclidae* (Dippers), the nidification of which was described in vol. i of the present series. It also includes the *Irenidae* (The Fairy Blue Bird), *Oriolidae* (Orioles), *Graculidae* (Grackles and Stares), and *Sturnidae* (Starlings and Mynas), which come into vol. iii of the *Fauna*.

As noted by Mr. Stuart Baker in his preface, the total number of species and subspecies dealt with in the book under review amounts to 540, of which 13 have been described or resuscitated since the publication of the *Fauna* nine years ago.

Of this number, seventy-five birds do not breed within the limits of the Indian Empire, and of the remaining 465 species and subspecies the nidification of no less than 403 is now described, the percentage being roughly eighty-six as against fifty-five included in Hume's *Nests and Eggs.*

The sixty-two of which nothing is so far recorded are mostly birds which breed in the higher Himalayas or the extreme East and South of Burma, so that field workers having access to these localities still have scope for much useful work.

Apart from those of which nothing at all is known, the nidification in some cases requires confirmation, and in others only a single nest and eggs are recorded, and although the authenticity of such unique specimens is not in question, the desirability of further material is obvious.

A case in point is the race of *Acrocephalus stentoreus*, the Reed Warbler which breeds on the Inle Lake in the Southern Shan States. Although Mr. Livesey has taken a number of nests and eggs, the exact status of the bird is still in doubt.

Similarly, the Bush Warbler of the genus *Horeites*, which occurs in the Shan States and is not uncommon at Maymyo requires identification. The bird is a great skulker, breeding in dense tangled undergrowth, and I remember Harington telling me that he had obatined both birds and eggs after endless search, but neither the eggs nor Harington's notes appear to have been available to Mr. Stuart Baker.

Such instances can be multiplied, and are cited, not in a spirit of criticism, but to draw attention to the fact that, despite the immense advance in our knowledge of breeding habits that we owe to Mr. Stuart Baker's labours, much still remains to be discovered by the enthusiastic ornithologists of the present day. To name but one locality, with which I am personally acquainted, there are still many discoveries to be made in the evergreen forests and mountainous regions of South Tenasserim.

Bearing in mind the extreme rarity of many of the birds dealt with in the present volume, and the inaccessibility of their breeding haunts, it is impossible to express in words one's admiration for the immense mass of material that Mr. Stuart Baker has collected and collated.

Moreover, in addition to that scrupulous accuracy of scientific detail that one associates with all his work, the information is imparted in that felicitous style that one has long been accustomed to associate with the author's writings. Far from being a dry catalogue of scientific data, the whole book is pre-eminently readable, and will revive many happy memories for those who, like myself, are no longer workers in the field.

The book contains six beautiful photographs, the work of Capt. and Mrs. Bates, and one hopes that Mr. Stuart Baker may find it possible to include even more in his subsequent volumes.

The same type has been used as in the first volume, which renders the letter press very easy to read, and I have failed to detect a single printing error. It is true that a few place names are misspelt, but here the fault lies with his correspondents and not with the author, and even so they are easily recognisable.

C. H.

III. THE JUNGLE IN SUNLIGHT AND SHADOW by F. W. Champion, M.A. (Oxon), F.Z.S., Imperial Forest Service of India (Author of *With a Camera in Tiger-land*), Chatto & Windus, London, 1930, 270 pages, 95 illustrations, Price, 21/-.

More than five years have passed since we had the pleasure of reviewing Mr. Champion's former book *With a Camera in Tiger-land* (Journal of the Bombay Natural History Society, vol. xxxii, p. 775). It was the first book, illustrated throughout with photographs of wild animals in their natural surroundings, ever published about the wild animals of India. Now comes this larger, more profusely illustrated, and yet cheaper volume from the pen and camera of the gifted author. The book is wonderfully light for its size, is well arranged, and has large print.

The publication of this work comes at a very opportune time because the powerful advocacy of Mr. Champion is a much needed stimulus to recent movements in this country, and in other British Possessions in the East, towards the Protection of Wild Life which has become so urgently necessary.

In his introduction, the Author informs the reader of the objects and hopes with which he has designed the book. These are, among others, ' . . . in the even greater hope that it may raise a deeper sympathy for wild creatures: that it may give some sportsmen cause to think twice before they pull trigger on animals that, possibly, they often gain nothing by shooting; . . . .': All these he should amply attain.

In the former book there were some animals of the United Provinces forests which had not been 'shot'; among others the sambur, barking deer, wild dog, and some of lesser note but not of less interest on that account, and now these are all pictured to us by pen and by camera in their natural surroundings.

Every one of the twenty-six chapters in the book is complete in itself, and each a model of its kind, compelling thought towards that deeper sympathy for wild creatures which human beings must have if wild life is to be preserved and allowed the right to live which is the heritage of all animate things.

The author quite rightly remarks that Nature would seem to be intensely cruel, which in fact it is not. 'Yet it *is* difficult for the reasoning human being —the only animal which is intentionally cruel—to admit this. There is the snake which swallows frogs alive, or other snakes; that seems horribly cruel, and so on . . . However, let all who ponder on the cruelty of Nature, the inexorable Laws of Nature, read carefully all that there is in this book, especially the last chapter "The other side of the picture".'

Now let us pass the book in review. The first chapter reveals the literary talent of the author who could, if he wished, be famous as a writer of short stories! In this there are lovely pictures of elephant and sambar; and that of the hyaena brings to memory the many occasions on which the furtive purloiner of others' dinner went off in just this way with a joint from the kill of tiger or panther.

Next comes a life-like description of a tiger at home. Every word of this chapter most vividly portrays the life of the forest creatures. Only one who has held many an all-night vigil in the jungle could write with such intimate knowledge as this.

After the Tiger, the Pangolin, a creature seen by few. The present writer once found a dead pangolin in the Ganges Kadir, a victim apparently of snake bite. It was 3 ft. 10 in. in length, tail 1 ft. 10 in., tongue 14 in., centre claw 3½ in., weight 29 lbs. and obviously full grown. One sometimes meets with dead pangolins in the jungle, apparently killed by panthers. The chapter gives much interesting information and is illustrated with five perfect photographs of this peculiar animal.

Quite true! The tiger is not a cruel beast; he kills because he must in order to exist. Perhaps his early efforts are cruel—to our ideas—but they are not intentionally so; and it is a fact—as those of us who have experienced sudden and extensive injuries, broken bones, maulings by tiger or by bear, can testify—that the shock of the impact deadens all pain. Yes, the human being *is* cruel —think of all the creatures condemned to life-long imprisonment behind the bars—the tiger is not. Hand in hand with game preservation should go a sufficient measure of protection to the greater Carnivora.

Now the reader is in the forests of Oudh. He sees the stately Sarus crane.

Its sonorous cry is now heard in Whipsnade Park! Also the foxes, the crocodiles, the pythons, just as those of us who have had the fortune to know those forests have seen them in their native haunts. All is so readable, so vividly true, so full of 'meat'! And then the few forceful lines of wild life propaganda at the end of it; and of other chapters also.

The question as to why the horns of the numerous sambur stags of those forests are so poor in comparison with those of the Central Provinces is considered, and various theories are discussed. It cannot be that the flatness of the Oudh forests has resulted in the production of a local race with a tendency to produce small horns, as the sambur of the Himalaya, which are found at an elevation of as much as 9,000 ft., can show no better heads. The sambur of South India, hills and plains alike, have comparatively small horns; so also in Burma, where the horns generally are not much better than those of Oudh; and in Ceylon where the horns of both sambur and spotted deer are small in comparison with those of the Central Provinces. In parts of Central India sambur horns tend to become abnormal both as to thickness and number of points. It is a baffling problem, and can be considered in respect to other animals—black-buck for instance—the horns of which are smaller in the south than in the north, chinkara too.

Now the Ratel; another animal seldom met with. The writer has only seen two in forty-three years of jungle jaunts; once in Kheri, once in Hoshangabad. There is a most interesting account of this animal, with five excellent pictures. All will be grateful to the author for this chapter and that on the pangolin.

Space does not permit of more than a passing mention of 'A Winter's Morning in the Khotri Doon'. Pictures of pig and panther, and all about the monkeys and birds; the pheasants and the leopard cat which stalks them; and the serow standing immovable as a statue on the edge of the forest in the fading light of the dying day.

'What is the use of the leopard'? It is good to read some words of praise of this indomitable beast, and not the abuse of some writers who describe him as 'a perfect swine', 'to be killed by any possible means', and so on. There are sound reflections upon the balance of nature and need for some protection of the Carnivora. Of course if the game is not protected the Carnivora soon finish off the diminished stock and then take to the cattle and the people, to finally disappear from that part of the country. This has happened in several parts of India now denuded of all the larger wild animals. The time has certainly arrived in many parts of India when all shooting of every description should be stopped for a period of years. In others there should be protection of the Carnivora and in others the protection of certain species only. Throughout the Indian Empire shooting by night should be prohibited and the use of the motor car as a direct aid to destruction of wild life be most drastically dealt with. In fact what is wanted in all the Provinces of India, and in Burma, is a Department for the Protection of Wild Life: then perhaps something may be done. But we seem to have strayed from the forests of Oudh! There is a striking description of 'Drought in the Jungle' and a story of an elephant in the same connection.

Of the many lesser cats of the forests three are illustrated; the Common Jungle Cat, the Leopard Cat, and the Fishing Cat; and much of interest related about them. It is not said that hybrids of the first-named species with the domestic cat are not uncommon, and that hybrids of the domestic-cum-leopard cat are not unknown.

The author asks for explanation as to why the jackal should make such an appalling noise at night—'throughout the silent watches of the night'—But does this concert not occur mostly in the early hours of the evening, with a complete cessation from about two hours after dark to an hour before dawn? And may it not be that the howls are to call together scattered members of the band of prowlers for the nightly search for food? and again to collect friends and relations near the break of day?

The chapter on Swamp deer is beautifully illustrated; yet not to the satisfaction of the high standard of the author.

Mr. Champion remarks that the animal photographer is as scarce as he was ten years ago. There are several reasons for this. One is that the equipment is expensive and it is difficult to know where to get it. The writer of this review has struggled with many difficulties and not yet succeeded in obtaining necessary apparatus. Last year in London no dealer could be found who could supply a flashlight equipment! Now, by such ingenuity and manual dexterity as he possesses the camera with a suitable lens will be fitted by himself with a synchronizing arrangement to enable pictures to be taken by the light of the noiseless Sashalite bulb. It remains to be seen if there will be any result.

What is wanted is a Handbook, of not too technical a nature, to place the aspirant to this fascinating pursuit in the right path. Perhaps Mr. Champion will write such a Manual? It would convert many users of the rifle and save the lives of a great number of animals; for it cannot be gainsaid that the photographing of an animal is infinitely more difficult than shooting it: and is a very high form of sport.

'Freedom *versus* Captivity': with charming pictures of nilgai and chital and one of a bear. All who have intimate acquaintance with the jungle creatures will agree with the author that they do not live a life of terror. Most certainly they would not be, and are not, happier caged. There is great cruelty in caging animals and birds—especially the Carnivora and birds of prey—yet, although nine people out of ten will admit this, the thing goes on; and if you write an article about it it will not be accepted, 'because you are attacking an established institution'—the 4 o'clock feeding of the lions!

Chapter 13, 'Curiosity in Animals': and we are only half through the book. Read and enjoy; also learn. And pass on to 'A Foot-hill Stream' and see how much is due to the patient Balmati and her mahawat. That flashlight work is expensive. Ten rupees for each 'shot'!

'Bhaloo the Bear' and all about him. It does not seem likely that the sucking of paws by the sloth bear is a salve for bruised feet; for the baby bear one keeps in camp sucks his paws in quite a grown-up manner. The idea that he gets a taste of salt may be an explanation of the habit. Those four lines at the end by W.J.K.S. excellently describe Adam-zad, the bear.

'The Ganges Forests' must be but briefly referred to. Here again the faithful Balmati has been invaluable and given us lovely pictures of 'elephant children'; and what a unique picture is the flashlight photograph of the sloth bear with two cubs on her back.

'Jungle Camouflage' is instructive; and an excellent article on a very large subject. To which of the eleven or twelve known members of the genus krait does the remark of the danger to which we are constantly exposed from the 'inconspicuous dust coloured krait' refer? The Common Krait is the krait of the United Provinces and is a conspicuously marked snake having linear white arches, more or less in pairs, on a blueish ground. The author is so consistently accurate that he will excuse this small matter being noticed.

An Indian Hill Station in the Monsoon can be very dull to many people; but, as the author points out, some people never see birds, insects, or butterflies. He illustrates some of the creatures one can see, and one not likely to be seen unless specially looked for. The handsome Himalayan Flying Squirrel can be seen at dusk if it is known what tree they inhabit. That is the difficulty. Natives watch them parachute down to the foot of a tree and kill them with sticks. It was a wonderful feat to obtain the photograph that we admire. Are Station leopards half starved? A number shot at Chakrata and Ranikhet were of the usual weight. One carried along in the early morning was heartily cursed by the langoors.

'Hyaenas'. That is quite right about the hyaena. He was not created to fight, so why dub him cowardly? Speaking for himself the writer has never come across an instance of a hyaena driving a panther off its kill. The author has never heard the cry of the hyaena. He is right in saying that it is a very silent beast but it will utter the sound, well described by Dumbar-Brander as a 'sort of chattering laugh', when disputing a feast with another animal, a pig for instance. As remarked in former reviews the hyaena when hard pressed for food will kill adult women and big children.

'The Senses of the Tiger': with two excellent photographs. Many watchers in machans have no doubt heard and sometimes seen, as one might express it, unsuccessful sniffs as the tiger searches around for taint of man. All with the necessary experience will agree that the tiger has a poor sense of smell; yet that incident in the Pidoung Sanctuary, related in a former Review, rather shakes one's opinion. The tiger's sense of taste is a very preverted one to our ideas as he will eat a kill which is more 'rice' than meat! and he will quite often annex the kill of a panther, and sometimes of another tiger, if he comes across it on his rounds, though on those occasions he seems just to take his fill and pass along with no intention of returning to the easy feast.

It is good to read that the Siwalik Hills are still 'a happy home for countless numbers of God's wild creatures', as one thought that the animals and game birds had been sadly thinned out by the inhabitants of Dehra Doon Cantonment. A very good photograph of the Siwalik's, a quite perfect flashlight of a tiger, and a stag chital apparently in velvet.

Chapter 22 and the Sixth Sense. That article in *Blackwood's Magazine* for July 1931 was very intriguing. The writer drew the attention of 'Kim' of the 'Statesman' to it but was unable to follow the subsequent talk. There is no doubt some sense, apart from the five senses, which informs a human being at any rate of someone being close by. That was shown to the writer only last month. A sandy river bank and two Irulas, he of the tousled hair lying prone while the other deloused his head. The interesting operation was watched for fully a half minute. Then the operator looked up suddenly to find the white man standing within six feet of him. Some sense apart from the ordinary five must have told him of this. So it may be with animals. The writer has certainly had warnings of danger in the way of accidents and learnt not to disregard them. As Shaik Badulla of Orrcha used to say: '*Jab dil bolta jaunga; jub dil nahin bolta kabhi nahin jaunga*'.

Now read all about tiger tracks and study the matter with the aid of the photographs; and then about the kill being on the left side or the right side; and the direction in which the head is pointing; and kills in the open. There are more of these sort of beliefs not mentioned by the author. If the tiger you have shot has his tongue between his teeth then you will be again successful in a day or two; and the number of lobes in his liver will tell you his age; and some more of the same kind, including a new one told to the author by a jungle man.

Do tigers eat carrion? The answer to this is in the affirmative, as they say in the 'House'. In the Upper Chindwin country it is usual to put out the carcase of an animal if you want to shoot a tiger; also see previous remarks.

There are other 'Jungle Riddles' discussed in this chapter and the next, and perhaps by writing about these the author may attract to the pages of our *Journal* interesting observations on all these matters by Members of the Society.

Your reviewer would like to say that he is not a famous hunter and is in agreement with all the author says as to the alarm calls of the langoor. That is it; the pitch and the violence will tell one the true alarm from the false: and in connection with alarm calls is it not possible to say from the tone of a sambur's call that the alarm is caused by a tiger or by a panther? That is what the present writer thinks he can quite frequently distinguish.

Chapter 26 discusses 'The other Side of the Picture' with, incidentally, pictures of chital, panther, and a sambur hind; also two good reasons why the jungle need never be lonely.

The whole of this chapter should be read and re-read; and further than this it may be said that this book should be where it can be often taken up and looked into, for in it is all that a lover of nature, or one seeking enlightenment, could wish to have to inform and guide him.

This Review seems to have come to a great length. Has it been too appreciative? Possess the lovely book and judge for yourself and you will be grateful to Mr. Champion for having written it.

R. W. B.

## IV. The BOOK OF THE TIGER.

It is with much diffidence that I comment on a review in this *Journal* (vol. xxxvi, No. 3) of a book of my own, but there is a precedent on page 209, vol. xxx, where the author of *Wild Animals in Central India* has replied to some criticisms of his work. I have myself reviewed many books and am sensible of the difficulties of the reviewer, as he is of those of the author. All that the author can ask of the critic besides accuracy and discrimination is that he should be as well equipped as, or better than, himself to deal not only with a part but the whole of so vast a subject, involving an extensive field of research besides the experience of the field naturalist, in which capacity the reviewer speaks with unrivalled knowledge and experience that I cannot for a moment claim. The reviewer has also to take into consideration all that a book contains, and not merely occasional omissions or isolated items on which, moreover, a light may be cast by other and perhaps unnoted passages, as for example on the senses and on colouration in Chapter I, in addition to Chapter II of my book.

*The Book of the Tiger* is not intended to be a scientific treatise, but merely, as stated in the Preface, to 'present a comprehensive view of the animal', with so much detail as is essential to offer a general idea of its nature and habits, and not an exact description of every attribute and action. It is of necessity largely dependent on the accumulated experience of many observers over a prolonged period, which is in the nature of things more extensive than that gathered by a single individual, although the experience and opinions on the subject of different people must have different values. One who has, in years long gone by, made occasional visits to jungles cannot possess the obvious advantages of prolonged residence in the wilds and of resources in information and personnel available to Forest Officers, of which such excellent use has been made by Messrs. Dunbar Brander and Champion, who have in their books depicted every movement of the tiger in description or in photographs.

In writing such a book one may omit many things mentioned elsewhere in one's own publications or in those of other authors, some perhaps being too trivial to notice. I must refer to a few passages in the review which need not vitiate the value of the whole any more than, as the reviewer kindly says, the reader from his criticisms 'might wrongly conclude that the book is of little value'. With regard to the complaint that I have not 'pronounced judgment', I certainly would not do this dogmatically concerning points which embody not only facts but theories, or where action or habit is not uniform but varies with circumstances. In the first category are theories relating to evolution and colouration, and in the second the tiger's methods of hunting and killing. Has the time yet come to settle finally such things as the uses of the senses of hearing, seeing, and scent, or the proportion of the sexes? On many matters, including that of the length of tigers, I have reached the same conclusions as the author of *Wild Animals in Central India.*

There is no 'effort to be original' in the suggestion that 'cleanliness in a beast of prey may reduce the probability of detection by scent on the part of a prospective prey'; the remark is not original, but is that of a scientific naturalist who specialised on the *Felidae.* It may be fantastic, but is given for what it is worth. The reviewer asks: 'Who can say what the powers of vision of animals are at night?' It may be added, 'or by day?' As remarked in my first chapter, 'the structure of the visual organs of the tiger is adjusted for hunting by day and by night', and surely we can advance some speculative suggestions as to what is beheld by the eye, whose structure is practically identical in all mammals, including man, although in the *Felidae* and some other animals a brilliant pigment increases the powers of vision, especially in a feeble light. The question is less one of sight than of perception, a matter dealt with on pages 123-124 of my book. The tiger's reason for hunting by night when 'the animals he hunts are on the move themselves' is clearly indicated in my remarks on nocturnal habits on page 115.

As for the length of tigers, enough is as good as a feast. I have purposely omitted many 'records', including that of Satunin referred to by Professor Pocock on page 522, of vol. xxxiii of this *Journal;* the Russian naturalist, we are told, states that he saw in the flesh a Transcaspian tiger whose stripped skin measured from the tip of the nose to the *root* of the tail 11½ ft. Perhaps there is a mistake in translation, *koren*, root, being confused with *konchik*, tip, or *konetz*, end.

The reviewer has read part of the book with insufficient care. I did not, as he says, 'predate the entrance of the tiger into India to 5000 B.C., a conclusion based on the finding of a single coin.' I predated the entrance 'as far back as 5,000 years ago' (not 5000 B.C.), based not on the finding of a single coin, but of a number of seals engraved with figures of the tiger found in the 5,000-year-old ruins of the city of Mohenjo-Daro in the Indus valley.

I am not surprised that the reviewer is astonished at the '200-lbs. of beef eaten at a sitting'; this is an error in printing or transcription. The original manuscript gives 100-lbs., which is perhaps excessive, although it is said in *Wild Animals in Central India* that a tiger will eat 'three-quarters of a fair-sized buffalo at one meal'. I regret that my careless proof-reading should have put the reviewer to the trouble of writing ten lines on this matter; and that he has found it necessary to write fifteen lines because I overlooked a third instance of two tigers being killed with one shot.

My chapter on 'The Lion in India' is obviously a sketch and not an exhaustive monograph. The reviewer says that I make no mention of the records of lions shot by the Central India Horse near Goona. I have on page 278 referred sufficiently to these records in what I was told by two of the most famous Central India Horse sportsmen of those days. He adds that my views as to the disappearance of the lion from its former haunts would have been welcome, my views are expressed on pages 70, 272, and 280.

Finally the reviewer refers to the 'proud title' of *the Book*. The italics are his, not mine. The title is not one of pride; it was adopted as convenient and appropriate for a companion volume to Sir Alfred Pease's less comprehensive work, *The Book of the Lion*.

R. G. B.

# MISCELLANEOUS NOTES.

## I.—NOTES ON THE COLOURATION OF THE WHITE-BROWED GIBBON (*H. HOOLOCK* HARL.).

Reference: Mr. Charles McCann's notes on the Gibbon in vol. xxxvi, p. 395 of the 15th April.

I enclose notes by Major W. B. Shakespear, Commandant of the Military Police Bn. here, on a Hoolock of his. They may be useful as confirmation. On account of its colouration the Hoolock was considered a male until it changed to grey, or rather began to change, last cold weather.

"Our Hoolock when we got him (her) in late July 1927, was a greyish colour, gradually changing to jet black until about five and a half years old, when greyish patches were again visible. At six years old the whole body is of a greyish tinge, the hair next to the skin being a deep sandy shade. The big fangs (canines) came through between five and five and a half years. (Aijal, August, 1933.)"

1st. Assam Rifles,
Aijal, Assam.
*August* 23, 1933.

J. F. PEART,
*Captain.*

## II.—DAILY FLIGHTING OF FLYING FOXES (*PTEROPUS GIGANTEUS* BRUNN.).

In a note in vol. xxxv, pt. 3 of the *Journal*, a Gurdaspur correspondent suggests that Flying Foxes travel long distances daily. I can add two instances of this habit.

On the occasion of my first visit to Kulu in 1910, I was told that Flying Foxes which were believed to roost in Mandi invaded Ujji, that is Upper Kulu every night in the fruit season. The apple growers dealt with them by stretching wires among their fruit trees and also by shooting them when conditions permitted.

Another instance of considerable daily flights by Flying Foxes occurs on South Sentinel Island, to the north-west of, and 17 miles distant from the Little Andaman which is barely visible on the horizon. A large colony of these bats shares a Box and Cox existence with an equally numerous colony of Pied Imperial Pigeons. At daybreak the pigeons start off for the Little Andaman in small and large parties which continue to succeed one another for 30 to 40 minutes. During the last 30 or 40 minutes of daylight they return in like fashion. The moment the sun has set, out come the great bats and disappear over the anchorage in a long-drawn-out procession into the darkening east. They must return just before daylight and must have a good sense of direction for South Sentinel is a poor landmark even by day. Three times have I landed on this little desert island and each time have sworn *wallāh wa billāh* that I would never do so again. After the easy walking through the forests of the Great Andaman (always excepting the fearsome thorny canebrakes in the fresh water swamps) the going on South Sentinel is the reverse of pleasant. Through a scanty humus peep sharp points of limestone which tear one's bootleather while the undergrowth is unexpectedly resistant and is armed with cruel thorns. Innumerable fat, smooth, pink, land crabs crawl about the dry leaves underfoot and scuttle into holes in the limestone, while every 30 or 40 yards one encounters a robber crab, of the size and colour of a purple savoy cabbage and standing fiercely at bay in the gloom. These discouragements are nothing compared with the all-pervading stench of flying fox which soon drives one back to the beach. The Pied Imperial Pigeon must have a very indifferent sense of smell to be able to put up with his bat fellow-lodger. Why should either find it necessary to roost so far from their feeding grounds? I do not know what enemy they can fear on the Little Andaman.

INGATESTONE, ESSEX. M. L. FERRAR.
*October* 11, 1933.

## III.—BISON (*BIBOS GAURUS* H. SMITH) AND HYBRIDS IN THE MYSORE ZOO.

(*With a photograph*).

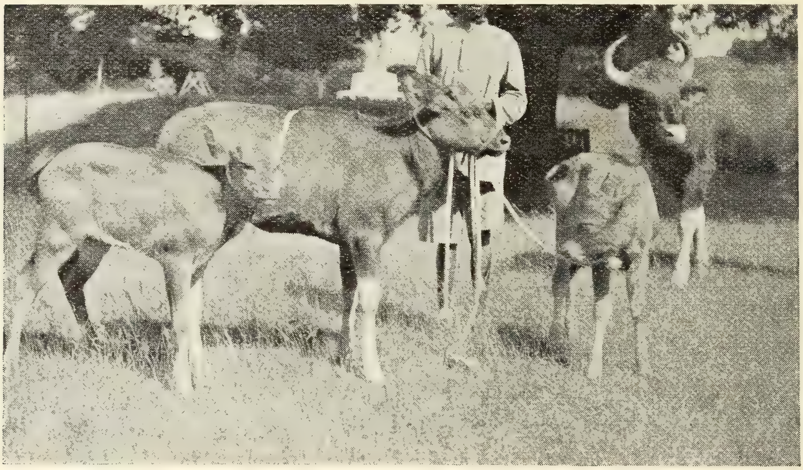
In the Mysore Zoological Gardens—officially known as the Sri Chamarajendra Zoological Gardens—are some bison calves captured in the forests by men of jungle tribes. Observation is kept on a herd, and when a calf is dropped the cow is driven off and the calf taken away.

Here is a photograph, taken on the 14th November 1933 with the kind permission of the Government, in which can be seen calves of several ages.

The small one on the left is about 2 months old; the centre one, a cow, about 4 months; the little one with head down, 25 days; and the young bull on the right is one and a half years of age.

It was very interesting to see these animals of different ages and observe the gradual changes in colouration. The two smaller animals are males. The smallest, is mouse-coloured, and shows no sign of the white stockings: the top of the head is very slightly darker than the other parts of the head and neck. The other shows slight signs of the coming white stockings and the top of the head is darkening. The 4-months' cow has obvious white stockings and the head is getting black.

The calves have as foster-mother a domestic buffalo cow which is very fond of her charges. All the animals are in excellent condition and enjoy the freedom and grazing of open paddocks.



A domestic cow is expected to shortly calve to a bison bull. This is probably a new hybrid; a similar cross to the Cattalo of the United States and Canada.

Hybrid lion-tiger cubs are also shortly expected, and the cross between wild dog and jackal is to be seen in one of the enclosures. In one of the animals, can be observed jackal feet and tail, and in the other, the tail and feet of the wild dog, with, in each case, a mixed colouration.

Another hybrid, the making of which one can but most strongly condemn, with the hope that such an experiment will never be again attempted, is a cross between a jackal and a Cocker Spaniel. Poor terrified little smooth coated black creature. Its pleading brown Cocker eyes will haunt me for many a day. It would be a mercy to end its unnatural existence.

Coonoor. R. W. BURTON,
*November* 23, 1933. *Lt.-Col., Indian Army* (Retd.).

## IV.—THE DISTRIBUTION OF THE GREAT PAMIR SHEEP (*OVIS AMMON POLI* BLYTH).

I return herewith your letter from the Bombay Natural History Society.

*Ovis poli* are found regularly in one nullah called Hak, just south of the Kilik Pass, within Hunza limits. I believe they used to be only casual visitors south of the Pass, but the Mir of Hunza, finding that they were much persecuted on the Chinese side very wisely gave them strict protection on his side for some years and they may now be considered to be established. There must be about 100 animals in this herd.

On the Chinese side they exist, in reduced numbers, in most of the side valleys of the Taghdumbash. I have seen them at Lup Gaz (immediately on the north side of the Mintaka), whence they must be occasional visitors into Hunza territory on the south of that Pass, and in the Kara Chukor Valley. They are still fairly plentiful in the Khunjerab and Paik Valleys and also towards Kara su and Tagharma north of Tashkurghan. Another place in Chinese territory, where I know of them, is the Muji Pami near the head of the Kashgar River.

They seem to be still very plentiful in the Russian Pamirs. W. J. Morden[1] who came out to collect specimens in 1926 for the New York Natural History Museum, told me in Kashgar that he had seen many herds all along the Russian side. To the north of Kashgar lie the foothills and main ranges of the Thian Shan. There are equally big wild sheep here but not, I think, *poli*. They are *Ovis karelini* and other varieties of *ammon*: my wife shot one near Aksu which the London Natural History Museum would have described as a new species altogether if it had not been a single specimen! Probably, there are various sub-species from Siberia to Turkestan, but I doubt whether the true *Ovis poli* exists anywhere north of Lat. 40°.

GILGIT. G. V. B. GILLAN,
*March* 28, 1933. *Major.*

## V.—THE LOCH NESS MONSTER.

It has occurred to me that owing to the publicity which it has received a number of your readers may be interested in the 'Loch Ness Monster'. Living as I do only a short distance from the loch and possessing as I believe the confidence of your readers I endeavour in what follows to winnow the 'wheat' from 'chaff' out of the monstrous publicity which envelops and obscures this phenomenon.

It is necessary to state right away that the subject cannot be dismissed as 'Bunk' or a mere Newspaper 'stunt'. The evidence is too overwhelming for that: in fact it is the great mass of evidence, often quite conflicting, which opens the door to the scoffer. The animal had been seen occasionally, months before it received any publicity; and it has since been seen by a number of reliable witnesses whose testimony it is impossible to ignore. It can be taken as established that a large animal, strange to the locality, does inhabit the loch. The question then arises 'what animal'?

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[1] Vide 'Notes from an Expedition for *Ovis poli*' by W. J. Morden, *Journ. Bom. Nat. Hist. Soc.*, vol. xxxiv, p. 142.—EDS.

There is a contention that the animal is prehistoric and not known to science. The evidence in support of this is such as cannot at present be accepted by any cautious naturalist: the more improbable the event, the stronger is the necessary evidence for its acceptance.

The evidence therefore for the prehistoric animal, which in itself is weak, must, be rejected, in favour of the evidence, which is stronger, and which supports the presence of a known animal. So far no investigation has been carried out as to what the animal feeds on: but it must either be herbivorous or carnivorous and moreover an animal of such bulk must require a generous diet. The vegetation on the banks of the loch consists of bracken, some rushes, larch, Scotch pine, alder and various other trees. It is obvious that the depredations of a shore feeding animal would by this time have become apparent and there only remains aquatic plants. The loch is deep and rocky; there are practically no aquatic plants save, possibly, those in the extreme bottom; it is therefore very improbable that the animal is herbivorous. A carnivorous diet, is a much more concentrated form of food, than a herbivorous one, and of the former there is ample; trout, salmon, eels and possibly land animals which water at the loch. The loch itself drains out partly in the Ness River, and partly in a section of the Caledonian Canal: the intake to the canal is supported by a ramp or 'bund' of small height and easy slope, presenting no real obstacle to any fish or sea mammal: and the Ness River which commences below the ramp for its 8-mile journey to the sea contains ample water to carry an animal of the size and nature which on all accounts we are discussing.

It can therefore be fairly certain that some marine animal has forced its way up the Ness River into the loch and has failed to find its way out. There are two local animals which might fit the evidence so far obtained. One 'The Basking Shark' which is fairly common and attains a length of 30 feet but it is not known if this animal will live in fresh water and it is doubtful if even in its most enthusiastic moments it would face fresh water.

The other local animal is the 'Grey Seal' which in its colouration would account for the conflicting evidence as to the monster's appearance. It attains a length of 10 ft. which is ample to account for the descriptions of the beast after one has lopped a few feet for exaggeration and excitement: (*N.B.*—A few feet have been lopped off Indian Tigers!) Salmon over 7 in. is its chief diet and it is probable that a Grey Seal enthusiastically followed up a big run of Salmon into the Ness River and seeing them escaping up the river into the Loch itself, adventurously followed them up. Time will show unless some barbarian puts a bullet into it; no foundation at present should be placed on sensational stories as to its being prehistoric or antediluvian.

A. A. DUNBAR BRANDER.

Ivybank, Bishopmill,
Elgin, N.B., Scotland.
*February* 9, 1934.

## VI.—EXPLOITATION OF WILD LIFE (CEYLON).

The following figures are of interest and give cause for serious thought. They were kindly supplied to me by the Principal Collector of Customs, so that I can keep all my records and data up to date.

I give the figures for 1931 and 1932.

1. Skins, raw and salted, of wild animals, exported during 1931 and 1932.

| Nature of skins. | Weight. | Value. | Weight. | Value. |
|---|---|---|---|---|
| | Cwts. | Rs. | Cwts. | Rs. |
| Crocodile ... | 176 | 24 300– | 232 | 39 100– |
| Talagoya ... | 24 | 13 500– | 168 | 39 000– |
| Python ... | 2¾ | 1 433– | 23 | 14 800– |
| Reptiles, snakes ... | 28 | 1 325– | 25 | 8 600– |
| Mixed skins, ( ? ) ... | 353 | 58 000– | 324 | 49 100– |
| Leopards ... | 17 | 3 265– | 23 | 7 005– |
| Totals ... | 600¾ | 101 823– | 795 | 157 605– |

There is no export duty on these skins.

*Note.*—Taking the average weights for the skins at a high figure, we get the following truly amazing number of wild animals killed and destroyed, to suit a whim of fashion! These were *killed*, how many were left wounded and died?

Crocodile. At an average of 10 lbs., means that in 1931, 1,936 of these animal skins were exported. In 1932, some 2,552 crocodiles were killed for this export figure alone.

Talagoya. 1932 figures show an increase of some 4,000 of these useful animals having been killed, as compared with figures for 1931.

Python. At an average of 8 lbs., 322 pythons were killed in 1932, against some 37 only in 1931.

It is difficult to estimate, or even guess at the total of snake skins needed to make up one hundredweight, perhaps 50? At that figure, in 1932 alone some 1,250 snakes were killed to supply the skins exported.

Leopard. At an average of 10 lbs., salted and raw, gives 253 leopards represented by the export figures for 1932.

Other figures of interest are the statements of animals exported from Ceylon, during the years 1931 and 1932. I am not aware how the 'value' has been arrived at.

| Animals. | 1931. | | 1932. | |
|---|---|---|---|---|
| | Total No. | Value. | Total No. | Value. |
| | | Rs. | | Rs. |
| Elephant ... ... | nil. | ... | nil. | ... |
| Bear ... ... | 1 | 50-00 | ... | ... |
| Deer ... ... | 2 | 200-00 | 1 | 250-00 |
| Palm cats ... ... | 8 | 55-00 | nil. | ... |
| Mongoose ... ... | 7 | 70-00 | 1 | 5-00 |
| Lizards ... ... | 41 | 40-00 | nil. | ... |
| Monkeys ... ... | 27 | 245-00 | 30 | 310-00 |
| Snakes ... ... | 117 | 250-00 | 24 | 200-00 |
| Pythons ... ... | nil. | ... | 1 | 200-00 |
| Squirrels ... ... | 1 | 5-00 | nil. | ... |
| Owls ... ... | 2 | 5-00 | nil. | ... |
| Frogs ... ... | 51 | 10-00 | nil. | ... |
| Porcupines ... ... | 2 | 15-00 | 1 | 10-00 |
| Peacocks ... ... | nil. | ... | 2 | 200-00 |
| Wild cats ... ... | nil. | ... | 3 | 15-00 |

1931. 259 wild animals, representing a value of Rs. 945, were exported.

1932. 63 wild animals, at a value of Rs. 1,190.

No export duty on wild animals, excepting elephants.

Total value of produce of wild life, exported during 1931 and 1932, Rs. 2,61,563.

WEST HAPUTALE ESTATE, A. C. TUTEIN-NOLTHENIUS,
OHIYA. F.Z.S.
*October* 1, 1933.

## VII.—WOODSNIPE (*CAPELLA NEMORICOLA* HODGS.) IN MALABAR.

This snipe though uncommon, is stated to occur regularly during winter in the South Indian hill ranges, and several are shot every year in the Nilgiris, but I cannot find that it has yet been recorded from Malabar. It may therefore be of interest to report that I shot one on the edge of a large open rice stubble far from any dense cover such as this species usually frequents, on November 27, 1933, about 12 miles north of Cannanore and only 4 miles in a direct line from the sea coast. The bird was in excellent condition and weighed just under 6 oz. The skin was sent to the Society and verified.

E. G. PHYTHIAN-ADAMS,
*Major, I.A.* (Retd.),
F.Z.S.

NILGIRIS.
*January* 4, 1934.

## VIII.—NOTE ON THE WHITE-CHEEKED BULBUL (*MOLPASTES LEUCOGENYS*) IN SALSETTE, BOMBAY.

While collecting in Salstte Island last week, I shot a specimen of the White-cheeked Bulbul (*Molpastes leucogenys* subsp. *leucotis*?) which has a tiny patch of orange-coloured feathers on each side of the forehead, a few millimetres behind the base of the culmen. I shot another and this too has a less distinct but similar patch.

I cannot trace any reference to this, and shall be glad if you will let me have an opinion on the first specimen which I am sending you. You may make whatever use you like of the skin.

HUMAYUN ABDULALI.

GODREJ HOUSE,
ANDHERI.
*August* 17, 1933.

Many thanks for your letter of the 22nd inst. It is interesting to note that birds from Persia and Mesopotamia show the same trait.

I note that you express the opinion that the birds are probably escapes. The bird is known to occur in Guzerat and there does not appear to be any reason why it should not come down the coast as other birds have done. I saw quite a number of them at Goregaon where the specimen was obtained. On the 24th of January 1932, I saw several of these birds at Godhbunder. All the birds appeared to be in prime condition. I remember seeing them at Nala Sopara too.

EHA, in his *Common Birds of Bombay*, records that a 'Sind bulbul' of his escaped and then reappeared with a mate. This was in all probability also an escape, but at present it seems to me that they have either established themeslves firmly or drifted southwards, and should be given a place in the local avifauna.

HUMAYUN ABDULALI.

GODREJ HOUSE,
ANDHERI.
*August* 31, 1933.

## IX.—OCCURRENCE OF THE LARGER BLUE-WINGED PITTA (*PITTA MEGARHYNCHA* SCHLEGEL) IN EASTERN BENGAL.

Some years ago, Mr. F. Field kindly gave me a specimen of the Larger Blue-winged Pitta which he had collected at Barisal, Eastern Bengal, on 19 March, 1925. It was doubtless then on migration. This is the first record for India and suggests that the range of this little-known bird may be wider than is generally realised. This occurrence should have been recorded in print at the time but for some reason both he and I omitted to send it to the *Journal* and I now make good the omission. The specimen has been compared at the British Museum and agrees well with the series in the Hume collection, except, that it is slightly paler in colouration both above and below than most of the specimens.

CALDBEC HOUSE, HUGH WHISTLER,
BATTLE, F.Z.S.
*September* 8, 1933.

## X.—CATCHING OF CHIKOR [*ALECTORIS GRAECA CHUKAR* (GRAY)] IN KASHMIR.

In the last issue of the *Journal* Mr. Stirling remarks that a common way of catching Grey Partridge in Rajputana is to chase them on ponies or with dogs. After two or three flights the birds can be picked up by hand in an exhausted condition.

This reminds me of the Kashmiri method of catching, or rather poaching, Chikor in winter. Two conditions are necessary for this purpose. First, there must be a fall of fresh snow sufficiently heavy to drive the birds down to the low foot-hills; and secondly there must be level ground at the base of these foot-hills. Given these conditions the procedure is as follows. Twenty or thirty villagers scatter themselves about the face of a hill-slope with an interval of say 150 yards between each man. When everybody is in position and the hill-slope is dotted with men at various altitudes and regular intervals, the drive begins. The birds are put up, fly a few hundred yards, settle, and are then immediately put up again by the nearest villager. At each successive flight the birds get lower and lower, and at last descend to the soft snow on the level plain where they flounder about in an exhausted state and are easily caught.

SRINAGAR. F. LUDLOW.
*January* 1, 1934.

## XI.—ON THE DISTRIBUTION OF CURLEWS AND GODWITS IN THE CENTRAL PROVINCES.

These birds are seldom seen in the Central Provinces south of the Nerbudda. All Curlews seen on inland tanks and jheels in the Nagpur and Bhandara districts have hitherto proved to be the Eastern Curlew (*Numenius arquata orientalis*, Brehm). One either comes across a solitary individual or a small flock of three or four birds. On the Mahanady River, however, Curlews are more in evidence and larger flocks may be met with. I shot specimens here in March 1925 and again in November 1929 and in both cases the birds were the Western Curlew (*Numenius arquata arquata*, Linn.). It would be interesting to note what forms are met with on the Nerbudda and in the districts north of that river, where I have had few opportunities of collecting.

The two races of Curlews are easy to discriminate; the Western form has the lower parts broadly streaked and the axillaries are white with bold streaks of blackish; the Eastern race has the lower parts finely streaked, and the axillaries are white or finely streaked with blackish.

I have only once come across a Godwit and it was a black tailed one (*Limosa limosa limosa*, L.). It was a solitary individual associating with another wader, and was shot on the Sonegaon tank, 5 miles south of Nagpur.

CENTRAL MUSEUM,
NAGPUR.
*December* 7, 1933.

E. A. D'ABREU,
F.Z.S.,
*Curator*.

## XII.—NUPTIAL PERFORMANCE OF THE SPUR-WINGED PLOVER [*HOPLOPTERUS VENTRALIS* (WAGL.)].

Stuart Baker (*Fauna*, vi, 186) remarks that 'the flight, walk and general actions of *Hoplopterus ventralis* are very like those of the Peewit', so that I venture to put on record some remarkable antics of *Hoplopterus ventralis*, which I observed in March 1932 on a sand-bank on the Namti stream in this district. I have watched hundreds of Green and Ringed Plover in England in the breeding season and never saw anything remotely approaching this performance. There was a party of four birds on the sand. First two approached each other slowly, and then stooping their bodies until they were in a horizontal position, whirled rapidly round on their 'axes', twice or thrice, describing a complete circle. (The Peewit stoops and bows in a similar position but I never saw one whirl round in this way.) They then drew themselves bolt upright, so that they appeared to be standing erect and as it were, on tip-toe, with bodies held vertically and breasts puffed out, and in this, for a wader, extraordinary position, ran, or rather shuffled, with short quick steps side by side, exactly as if 'dressing by a flank' (to use the term which alone seems to describe their movements). At times all four birds were running, or shuffling, side by side in this alignment almost touching each other. Occasionally one would bob his body up and down and then square up to another bird, with a threat of a blow from his wing, but I saw no actual fighting. The Spur-winged Plover is so common, and the use to which it puts the formidable curved spur on its wing, is so little known, that I sincerely hope some other naturalist will endeavour to confirm this observation, and prove whether or not the spur is actually used as a weapon of offence in the breeding season.

MYITKYINA, UPPER BURMA. J. K. STANFORD,
*November* 20, 1933 I.C.S.

## XIII.—EARLY ARRIVAL OF SNIPE IN THE ANDAMANS.

In vol. xxxvi, No. 2 of the *Bombay Natural History Journal* I wrote that I had shot snipe on August 28th in the Andamans. This year on August 17th I put up two snipe in one of our best beats. The birds, however, did not arrive in any quantity till the middle of September. Of course, the two birds may have been pricked birds which had remained in the Andamans throughout the year. They were strong on the wing and appeared to be in good condition.

PORT BLAIR, J. MILES STAPYLTON,
ANDAMAN ISLANDS. I.C.S.,
*October* 5, 1933. *Deputy Commissioner.*
*Andaman and Nicobar Islands.*

## XIV.—OCCURRENCE OF THE EASTERN GREY DUCK (*ANAS P. ZONORHYNCHA* SWINHOE) AND THE BRONZE-CAPPED TEAL [*EUNETTA FALCATA* (GEORGI)] ON THE BRAHMAPUTRA.

On December 29th I shot 2 Eastern Grey Duck (*Anas p. zonorhyncha*) on a bil on the north bank of the Brahmaputra—one out of a pair and one out of a lot of 8 or 10.

On December 25th a Bronze-capped Teal (*Eunetta falcata*) was shot in the same locality.

DIBRUGARH, J. C. HIGGINS,
ASSAM. I.C.S.
*January* 3, 1934.

## XV.—DATES OF ARRIVAL OF MIGRANT BIRDS IN COORG IN 1932.

August 21. Grey Wagtail—*Motacilla cinerea* Tunstall.
August 28. Common Sandpiper—*Tringa hypoleucos* Linn.
September 9. Pintail Snipe—*Capella stenura* (Bonaparte).
September 12. Common Indian Bee-eater—*Merops orientalis* Lath. (Local migrant).
September 26. March Harrier—*Circus aeruginosus* (Linn.).
September 26. Brown Shrike—*Lanius cristatus* Linn.
September 25. Green Sandpiper—*Tringa ochrophus* Linn. (first seen but had doubtless arrived much earlier).
October 3. Black Drongo—*Dicrurus macrocercus* (Vieill.) (Local migrant).
October 5. Blue Rock Thrush—*Monticola solitaria* (P. L. S. Müller).
October 7. Forest Wagtail—*Dendronanthus indicus* (Gmelin).
October 11. Eastern (?) Swallow—*Hirundo rustica* Linn.
October 11. Indian Pitta—*Pitta brachyura* (Linn.) (Local migrant).
October 12. Blue-headed Rock-Thrust—*Monticola cinclorhyncha* (Vigors).
October 14. Indian Tree Pipit—*Anthus hodgsoni* (Richmond).
October 14. Indian Oriole—*Oriolus oriolus* (Linn.) (Local migrant).
October 26. Himalayan Blue Chat—*Larvivora brunnea* Hodgs.
October 31. Indian Great Reed Warbler—*Acrocephalus stentoreus* (Humpr. & Ehreub.).
November 1. Pied Crested Cuckoo—*Clamator jacobinus* (Bodd.) (Local migrant).
November 1. Black-headed Cuckoo Shrike—*Lalage sykesii* Strickl. (Local migrant).
November 4. Verditer Flycatcher—*Stoparola melanops* (Vigors).
November 7. Hodgson's Rose Finch—*Carpodacus erythrinus* (Pallas).
November 9. Paradise Flycatcher—*Tchitrea paradisi* Linn. (Local migrant).
November 13. Red Breasted Flycatcher—*Siphia parva* (Bechst.).
December 25. Hoopoe—*Upupa epops* Linn. (Local migrant).

COOVERCOLLY,
SOMWARPET.
*September* 13, 1933.

F. N. BETTS.

## XVI.—EXTENSION OF THE RANGE OF THE SNAKE *CONTIA PERSICA* ANDERS. IN THE PUNJAB.

Among some snakes sent to me from Sakessar, 4,500 ft. on the Salt Range by Mr. A. D. R. D'Abreu, Civil Surgeon, Sargodah, was a specimen of *Contia persica*, Anders. This snake inhabits Persia, Baluchistan, the North-West Frontier Provinces and has been taken at Murree; the present locality extends its range further south into the Punjab. Other snakes from the same locality were *Zamenis rhodorhachis*, Jan. and a Phoorsa *Echis carinata.*

Central Museum, E. A. D'ABREU,

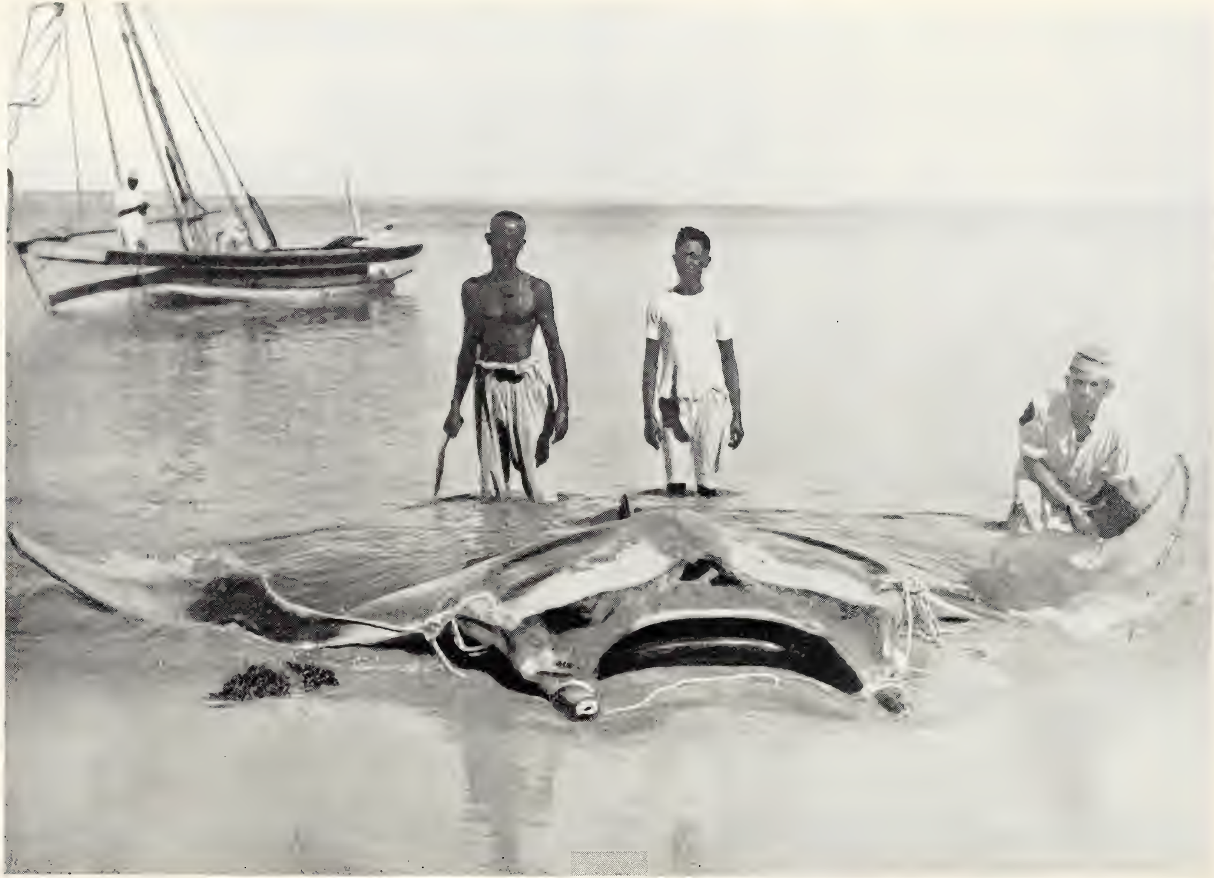
Nagpur. F.Z.S.,

*December* 7, 1933. *Curator.*

## XVII.—A WHIP-SNAKE (*DRYOPHIS MYCTERIZANS* DAUD.) FEEDING ON THE LIZARD (*CALOTES VERSICOLOR*).

The other day at Andheri, I saw a Whip-Snake capture the lizard commonly known as the "Bloodsucker" on a wire fence. The snake caught the lizard just behind the head and held it firmly. The lizard in its struggles dropped off the wire and dangled in the air while the snake maintained its hold. The Bloodsucker was very active at first, but gradually it quietened down, its movements became feeble and were eventually stilled. As death approached the lizard changed colour from light brown to dark brown.

When the lizard stopped struggling the snake gradually moved its jaws alternately till it got the head lengthwise into its mouth. It now commenced to swallow it, hanging head downwards from the wire. The body of the victim gradually disappeared leaving the tail protruding. When the body of the lizard past the head the snake altered its position. It put its head on one of the upper wires of the fence and by contortions of the body pushed the lizard down till it reached the stomach, the snake rising higher and higher as the lizard went down. All this time I remained perfectly still and carefully followed the proceedings from about a yard away. The whole process was completed in twenty-five minutes. The interesting point is the gradual death of the lizard from the poison of this snake. Death followed in almost ten minutes after capture. It is well-known that the Whip-Snake is one of the back-fanged colubrines. It is poisonous only to its natural prey but is harmless to man. It may be freely handled and will alway give warning if it intends to bite, by opening its mouth wide before



Giant Bat-Ray beached near Cape Monze.

it does so, however, this is frequently all bravado. For the sceptic I might mention that I was bitten by the same snake while handling it and am still alive to tell the tale.

BOMBAY NATURAL HISTORY SOCIETY, C. McCANN,
BOMBAY. F.L.S.,
*September* 8, 1933. *Asst. Curator.*

## XVIII.—BATTLE WITH A GIANT BAT-RAY (*DICEROBATIS EREGOODOO*).

On the 18th of October I left Karachi in a 3-ton sailing boat on a fishing expedition to Cape Monze, 20 miles from Karachi harbour. There were seven of us in the boat; a crew of six Indians and myself.

We had a successful afternoon's fishing off the coast of 'Kophana' where we had a good catch of the locally known 'Camel fish' (*vernacular*: 'Dun-de-a'—*Chrysophrys berda*) and, later in the evening, we moved westward and had a good bag of herrings during the night.

Before daybreak on the 19th we anchored about two-and-a-half miles west of Cape Monze, the depth at that particular place being 20 fathoms. The weather was fine and the sea fairly calm with a flood tide. Soon after sunrise all lines were out and we were settling down to our day's fishing when, suddenly, the boat took a list as if hit by a tidal wave and after a number of rolls and pitches commenced to move through the water, being towed by something invisible at the end of our 30-fathom anchor warp. I ordered all lines to be taken in by which time the speed of the boat had reached a good 2 miles per hour. Astounded at this mysterious submarine force that had suddenly taken our boat in tow I joined the crew whom I had ordered to haul in the warp. Our efforts, however, proved futile as the force with which the boat was being towed was such that I expected the 2-inch warp to part at any moment.

For the next half hour we were thus irresistibly towed towards the open sea when, suddenly, the warp slackened and the boat almost stopped. I rushed forward and hauled in a good four-to-five fathoms of the warp. At first I thought that I was to be disappointed, in as much that I would never discover what was the mysterious being that had taken us in tow, but in a few seconds the warp was jerked from my hands with such force that I was nearly thrown overboard and we continued our 'joy ride' after taking a sharp turn landwards. A few minutes later the warp came to the surface and, about fifty yards ahead of us, a body which looked like an aeroplane broke through the waves, its wings working with terrific sweeps. It was then identified to be a Giant Bat-Ray. So powerful was the action of its wings that it splashed water to within a few yards of the boat. Fortunately, however, the monster did not approach us for it would have involved the possible danger of severe damage to the boat. Another long hour lapsed before the Ray showed signs of exhaustion when renewed efforts were made to haul in the warp. This was eventually done by all hands on the warp with a turn taken round the thwarts and mast. Meantime, I got ready 2 harpoons, an 8-inch hook, gaffs and all the rope that was available on board.

Inch by inch the monster was drawn nearer the boat when a closer examination revealed that it was securely entangled in the anchor warp which was looped round its body, passing between its cephalic horns and near its tail. I presume that it must have hit the slack warp a few feet above the anchor and, trying to defend itself it probably lashed backwards with its tail, every subsequent movement only serving to tighten still further the knot it had tied round its body.

Another haul brought the monster within distance of the harpoons and two of these were plunged into its wings simultaneously by myself and by one of the fishermen. This was the signal for another hectic time, the Ray resuming its frantic struggles to release itself from the various ropes that were, by then, securing it firmly. The powerful movements of its wings smashed the pole of one of the harpoons and a half-inch steel hook was straightened out as if it were a bit of soft wire.

The Ray gradually lost strength and, at this stage, it was evident that there was little chance for it to escape. It eventually came to the surface and the boat being drawn close up a battle with 'kukris' ensued one of the crew diving under the monster plunging a 'kukri' into its throat.

It was my intention to tow the Ray to Karachi in order to determine its actual weight and obtain photographs showing the full outline of its body. Unfortunately this proved impossible in view of its size and the fact that it would have taken at least twelve to fifteen hours to reach harbour. We were then 23 miles from Karachi. I therefore decided to tow it ashore, the operation occupying another two hours.

Seven and a half hours after the Bat-Ray had taken charge of our boat it was landed in a small cove near Cape Monze. The tide was then running out and I had to wait for this in order to take the best photographs under these difficult circumstances as it proved impossible to drag the creature any further up the sand.

The measurements which I determined accurately were: 22 feet from wing tip to wing tip; 17 feet from head (excluding cephalic horns) to the base of the tail, and 4 feet the tail itself. Cephalic horns, of a convoluted appearance, said to be used by the animal to draw its prey into its mouth, 2 feet 2 inches. Body rough, about 3 feet thick at the maximum point. Colour of a deep grey with white patches on either side of the spine; white below. Head flattened; mouth 4-foot, opening like a huge cavern between the cephalic horns. Teeth small, file-like, extending practically the full length of the mouth; I counted seven rows of these on the lower jaw and six on the upper. Tail hard, very rigid and disproportionately short. Eyes, placed on the outer sides of the cephalic horns, about 3½ inches in diameter. The fishermen say that the animal cannot see straight ahead but is dangerous when attacked from the side.

This Ray belongs to the family of *Myliobatidae*, genus *Dicerobatis* and is akin to the species *eregoodoo*. I find, however, that it differs from the latter in the wings which are more elongated and narrower near the centre; also in its tail which is definitely rigid and not whip-like. I estimate that its weight must have been between 4,000 and 5,000 lbs. The vernacular name of this beast is 'Karanj', smaller ones are caught occasionally in drift nets and during the winter months are frequently seen leaping out of the water. They are more numerous in the gulf of Kutch.

Ralli Brothers Ltd., N. A. TOMBAZI,
Karachi. F.R.G.S.
*November* 8, 1933.

## XIX.—THE TWO INDIAN SUBSPECIES *SATYRUS (EUMENIS) PARISATIS*, KOLLAR.

Subsp. *parsis*, Le Cerf.

Subsp. *shiva*, Le Cerf.

### A Correction.

Comparison of the series of specimens of these two subspecies of *S. parisatis* in the British Museum (Natural History) and Evans's *Identification*, p. 113, with the original descriptions by Le Cerf (*Annales D'Histoire Naturelle, Entomologie*, 1913) shows that some confusion of the names *parsis* and *shiva* has arisen, mainly owing to inaccuracies in the details given regarding the type-localities.

(1) Subspecies *parsis* is the form having on upperside hindwing the submarginal border broad and unsullied bluish white, and the subtornal black spot 'at least partly on the white band'.

The type-locality as given by Le Cerf is 'Toba (Népaul), vii, viii, 1907 (H. C. H. Cooper coll.), W. Rosenburg, 1911 (ex coll., Eug. Boullet), in coll. Muséum de Paris: 2 ♂, 2 ♂: Types.'

This form, *parsis*, is not from 'Nepaul', but from the opposite side of North India, the mostly very dry region of Baluchistan, the Tochi Valley, Kandahar and the Swat Valley.

In Baluchistan, where (See Evans, 'Buttfls. of Baluchistan', *J.B.N.H.S.*, vol. xxxvi, p. 198, 6) the late Mr. G. E. R. Cooper collected on the Toba Plateau, *S. parisatis*, Brigadier Evans informs me, is one of the commonest butterflies.

Thus 'Toba (Népaul)' is doubtless an error for 'Toba Plateau, Baluchistan', as the type-locality for subsp. *parsis*, Le Cerf.

(2) Subspecies *shiva* is the form having on upperside hindwing the submarginal border narrow and more or less sullied, and the subtornal black spot either entirely or mostly in the dark area away from ('en dehors de') the white border.

The type-locality as given by Le Cerf is 'Simla (Cachemyre) (Doncaster, 1910) ex coll. Eug. Boullet, in Muséum de Paris; 1 ♂, 2 ♀: Types.'

'Simla *and* Cachemyre' would probably be more accurate, as this form, *shiva*, is from Cashmere, Ladakh, Murree and Kangra to Mussoorie, that is, the N.-W. Himalayas, a less dry region than that for subsp. *parsis*.

In the series in the Brit. Mus. are two specimens, one labelled merely 'N.-W. Himalayas', the other a female taken by myself at Mussoorie on 1 June, 1912 at 5,600 ft., which are extreme examples of subsp. *shiva*, the white border on upper hindwing being narrow and so much sullied by extension into it of the dark area that it is almost macular.

Mackinnon and de Nicéville, in their Butts. of Mussoorie (*J.B.N.H.S.*, xi) record only one example of *S. parisatis* from Mussoorie, and I met with only the one example above mentioned in some five years of collecting there.

There are in the Brit. Mus. series two specimens from the Moore coll., one a ♂ ('Kalapani, 25, ix, 85') of the form *shiva;* the other a ♀ ('Kalapani, 1, ix, 86') of the form *parsis*. It may be that the label of one of these two old specimens is erroneous. The series of these two subspecies are correctely named in the Brit. Mus. (Nat. Hist.) collection.

In Evans's *Identification* (1932), p. 113, the names *shiva* and *parsis* against the descriptions should be interchanged, and *parsis* be substituted for *shiva* in that author's Buttfls. of Baluchistan, p. 201.

LONDON. H. D. PEILE.

*October* 15, 1933.

## XX.—A BUTTERFLY GROUND IN KULU.

No paper, says Brigadier Evans in his *Identification of Indian Butterflies*, has been written on the butterflies of Kulu. The task is no light one, for the Kulu Subdivision is not only extensive in size but is cut up by mountain ranges the passes over which run from 13,000 to 17,000 ft. and in consequence it possesses extremes of altitude, rainfall and climate that produce a diversity of conditions which can hardly find their match in a tract of similar area anywhere else in the world. Only long local residence coupled with leisure and freedom of movement would qualify any individual to write a first hand account of the butterflies of Upper Kulu, Rupi, Inner and Outer Sarāj, Spiti and Lahul all of which go to form the Kulu Subdivision. I am not aware that Spiti has been properly worked and even Lahul has probably some butterfly secrets still to give up. Of one man only am I aware who could have written a paper on the butterflies of at least Kulu and Inner Sarāj; that was the late Mr. A. Graham Toung so frequently mentioned by de Nicéville in his unfinished work on the butterflies of India. But for Mr. Toung the source from which he obtained his many articles remained somewhat of a trade secret for the sale of butterflies formed an important source of part of his slender, his too slender income. The ruins of the modest dwelling in which he lived near *Bajaura* were already grassed over when I first visited Kulu in 1910. Graham Toung's secret had died with him but was accidentally discovered by me in that year. It is with some shame that I have at last summoned up the energy to communicate this secret to others.

I had started butterfly collecting two years before in Lyallpur which despite the conversion of the desolate Ganji Bār into a rich agricultural tract could still only boast of some 40 kinds of butterflies. To this number I had added another 40 or 50 during brief visits to Simla but knew very little of Himalayan sorts especially the rarer ones. In April 1910 I left on a two months' recess to visit J—C— then in charge of the Kulu Subdivision. Four new Erebias at Palampur, then *E. shallada* and *V. xanthomelas* on the Bubbu Pass with some new *Lethes* as I dropped down into Sultanpur made a good start and I passed up the Valley to Nagar hoping for great things to come. Very great was my disappointment. Perhaps nowhere in the Himalayas is there such a dearth of butterflies as on the main road from Larji to Manali, some 40 miles of Valley rising from an elevation of about 3,000 to one of 6,000 ft. In a day's march one seldom sees more than 20 kinds and those all common. I had begun to despair of doing anything much in the butterfly line when late in May my host started for Outer Sarāj where he was to meet the Settlement Commissioner. It was also time for me to move on to Simla and get to work on the report for the writing of which my recess had been granted. We decided to travel not by the hot low route via Lārji but the higher one which rejoins it at Ptach. Accordingly somewhere near the ruin of Graham Toung's house we crossed the Beas and struck into the mountains to our left and following a little stream found ourselves at Garsa rest house. The elevation I forget but it is something below 5,000 ft. After breakfast I strolled down to the stream where it formed a gravelly pool shaded by bushes. There on the wet sand I found a number of strange butterflies quite unknown to me. During the next couple of hours I caught 3 *E. dolon*, a couple of *A. ambica*, a male *Dilipa*, a couple of *Pantoporia asura*, a *Spindasis nepalisus* and, chief of all, two *Calinga budde*. Others new to me were *Lethe pulaha*, *E. athamas* and *C. thyodames*. All of these I had to search Bingham for. What a catch for a beginner! Had I had fuller knowledge I would have stayed next day and caught more. I did not then know that I would later search Kulu in vain for two whole seasons without finding any of these excepting *asura* in any other locality. Next day's march yielded first, sitting on the road, numerous *Dichorrhagia* and *Stibochiana* never taken elsewhere, *Sephisa dichroa* and *Pararge moorei* seldom seen again in Kulu and further on we found swarms of *Chaetoprocta* and *Euaspa* and the three common *Amblypodais, dodonea, rama* and *ganesa.* Excepting the *Amblypodias* these also were new. For the last mile before the top the road passes up the middle of a great vault formed by immense horsechestnut trees then in full bloom. As far as one could see through the forest there was an undergrowth of tall irises and the lovely six-foot *Lilium giganteum* (or is it *himalaicum*?) the whole forming a scene of beauty I can never forget. Among the horsechestnuts floated numerous *P. philoxemus, Delias belladonna* and a few *Aporia habellica.* After crossing the pass there was little of interest except a few Rapalas and Theclas till we came to Jibhi under the Jalori Pass. There I took several good *neptis* including *yerburyi, sankara, ananta* and *narayana.* Almost all the butterflies taken during these 3 days were new to me and my excitement was only made greater when I found how rare some of them were. Three years later I was posted to Kulu as Assistant Commissioner and twice paid visits of 2 or 3 days each to Garsa in the hopes of repeating the catch of 1910 but on neither occasion had I one quarter of that great success. Furthermore, all the rarer butterflies taken by me at Garsa were never seen by me elsewhere in Kulu in spite of much hunting throughout the seasons of 1913 and 1914. The Garsa Glen emerges as the one place in Kulu where all the rare Kulu butterflies occurring at that altitude may be found. There may be other spots equally good but they escaped my search and one may safely assume that it was at Garsa that Graham Toung got all his good things.

For the rest of Kulu and Sarāj there is little to be said. The edges and glades of the higher forests and especially the thatches or sheepfolds found here and there among them are good for *Theclas, Amblypodias, Rapalas* and such like. As is usual elsewhere the passes and open hill tops attract some of the more pugnacious of the *Nymphalidae.*

The collector should not omit a visit to Lahul which can be carried out in 8 to 10 days and will add numerous fresh forms to his collection. Once over the Rotang Pass, 13,000 ft., a new set of butterflies present themselves. The first day spent among the delicious water meadows and barley and buckwheat fields of Sissu or Kyelang will long be remembered by the newcomer for the astonishing beauty and variety of the wild flowers and for the many new butterflies seen for the first time.

I regret that I cannot add a proper list to this brief account but my Kulu collection was far from being complete and has long since been given away piecemeal or broken up. I have written from memory.

If any student of de Nicéville has ever visited Kulu in the hope of lighting on some of the many rarities recorded by Graham Toung he has probably gone back disappointed. These lines have been written in the hope that some collector more knowledgable than I was 23 years ago will make use of my tip and work the Garsa Glen in a good season and make a rich haul. That glen has also another wonderful memory for me. One day towards evening in February 1914 I entered the horsechestnut wood from a higher hill near by. In the next ten minutes I saw anything up to 100 Monal rising in twos and threes from all over the ground. Never was there such a show of monal. I shot 5 and stopped shooting. Why they were gathered in such strength so low down the range I cannot imagine. During two winters I shot many Monal but never saw so strange a gathering of them. Do they feed on horsechestnuts?

INGATESTONE, M. L. FERRAR.
ESSEX.
*October* 11, 1933.

## XXI.—NOTES ON OBSERVATIONS OF SOME PECULIAR HABITS OF AN ANT-MIMICING SPIDER (*AMYCIAEA FORTICEPS* CAMBR.).

(*With 5 photos.*)

It is said that hunters can detect from afar the whereabouts of a rhinoceros, hiding under thick cover, simply by the sight of a particular kind of bird (the Rhinoceros-bird, a kind of tick-bird) that always flutters overhead or follows the animal in the hope of getting food in the form of ticks that infest the hide of a rhinoceros. Though the authenticity of this story is questioned, and we are not concerned with its veracity, a curious fact, to some extent similar to the above story, came under my observation, about *Amyciaea forticeps*, an aggressive, mimic of the red-ant *Œcophylla smaragdina.*

Early in October, 1931, while searching for spiders in a jungle very close to a village in East Bengal, my attention was drawn to a flock of peculiar minute insects, hovering vertically over a leaf of a small plant, at a distance of about 16 ft. from me. I approached the spot to examine the matter closely and try, if possible, to capture some of them; I thought they might serve as excellent food for some of the young spiders that I had been rearing.

As I got nearer, I noticed a small brick-red spider, *Amyciaea forticeps*,[1] on the upper surface of the leaf, quietly sucking the juice out of a red-ant (*Œcophylla smaragdina*). (Figs. 1a and b). It is rather peculiar as it has been observed in most cases that these spiders suck up juice from any one of the internodes of the red-ant and not from the abdomen which is full of juice and also easy to puncture. The insects were flying up and down round about the spider but did not dare sit upon the red-ant on the leaf. The spider seemed to be absolutely indifferent to the movements of the insects and was busy with its repast.

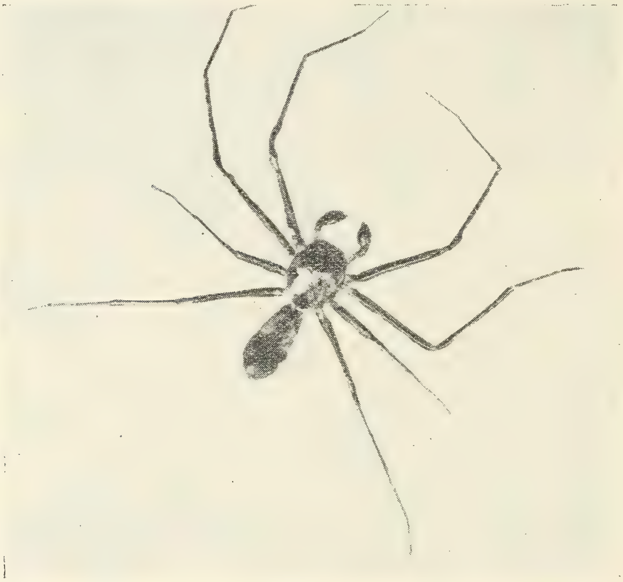


FIG. 1 a.—Enlarged photograph of *A. forticeps*, Cambr. ♂.

When I had approached within easy reach of the spider, it disappeared with such alertness in a series of rushes and pauses that I failed to follow it. The insects also disappeared. After a few minutes I saw them again flying over a twig of another plant close to the former one. At first I did not notice the spider though I was quite near it, as it had taken shelter under a leaf, but the insects, I noticed, were moving from one leaf to another. It struck me that possibly the insects were following the spider so I followed their movements very cautiously. Some eight or ten minutes elapsed before I found the spider crawling on to the surface of a leaf, over which the insects were now flying; I then caught the spider and put it in a glass tube.

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[1] (a) Simon, E., *Histoire Naturelle Des Araignées, Tome Premier*, p. 986 (1892-95).

(b) Hingston, Major R. W. G., 'Field Observations on Spider Mimics', *Proc. Zool. Soc. Lond.*, pt. ii, pp. 844-848 (1927).

(c) Mukherji, D. D., 'Report on a Collection of the Ants', *Journ. Bom. Nat. Hist. Soc.*, xxxiv (i), pp. 157-158 (1930).

(d) Pocock, *Proc. Zool. Soc.*, No. lvi (1927).

A few days later, just before the approach of dusk, the same kind of insects were found flying about something hanging in the air, which I observed from a distance of about 25 ft. The rays of the declining sun reflected from their wings, made the insects quite conspicuous even from that distance. On approaching the spot I found the creature to be the mimicing spider (*Amyciaea forticeps*) hanging from a leaf by its silk with a red-ant in its jaws. These spiders are generally very timid and afraid of the ants because of their bites. They stealthily approach the lines of the ants and when opportunity offers, snatch away a stray, weak or crippled member of the group. In this case the spider might have dropped down upon the thread for fear of the ants. The timid habits of this particular species of spider has also been observed by Mr. Kunhikannam of Bangalore.[1]

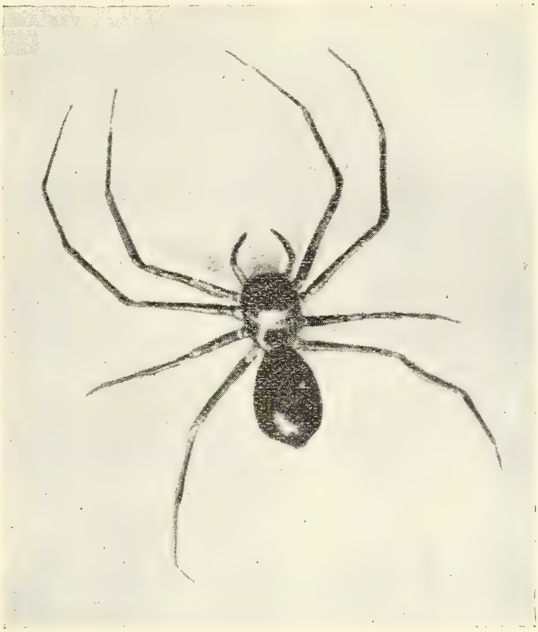

FIG. 1 b.—Enlarged photograph of *A. forticeps*, Cambr. ♀.

The insects that hover over the spiders, are in appearance like gnats with blunt proboscises and feather-like antennae. They measure about 0.3 to 0.7 mm. in length.

From various observations I was fully convinced that the hovering of the flying insects over leaves of plants or in air was a sure indication of the presence of this spider sucking the juice from a red-ant in that locality.

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[1] Kunhikannan, K., 'An Aggressive Mimic of the Red-Tree Ant', *Jour. Bom. Nat. Hist. Soc.*, xxxiv, pp. 373-374 (1915).

*Amyciaea forticeps*, Cambr. generally dwell on small plants or weeds, that grow around any big tree where red-ants are in abundance, while *Myrmarchne plataleoides*, Camb., which mimic the same ants, generally weave their retreats on higher branches of plants. In the *Records* of the Indian Museum, Dr. K. Narayan writes:—'Dr. Annandale tells me that he has seen this (*M. plataleoides*) or a very similar spider eating specimens of this ant *Œcophylla smaragdina*).[1] But I have never seen a *M. plataleoides* touching a red-ant for food and it is rather possible that Dr. Annandale might have seen a member of *Amyciaea forticeps* who very much relish those ants.

These red-ants (*Œcophylla smaragdina*) build their nests on high branches of trees and plants and occasionally but not generally, they come down the trunk of the tree to the ground in search of food. In the Royal Botanical Gardens, Sibpore near Calcutta, I have often seen these red-ants coming down to the ground in columns; this is specially the case during the rainy season when the termites attack the decaying wood, leaves and bark of trees. They are very fond of these termites and are often seen loitering here and there along the mud-roofed lines of the 'white ants'. In weak places of the mud roofings they make a small hole with their powerful jaws and thrusting their heads in, catch the termites. Sometimes they lie in ambush by the side of a breach of the tunnel and intently watch the movements of the termites and snatch one of them when opportunity arises.

The mimicing spider makes good use of this opportunity to catch its victim, the red-ant, which has wandered from the file to get its prey, the termites. The spider waits its chance and attacks the ant as it halts apprehensive of danger and after a short tussle drags the victim to a suitable place. In the Botanical Gardens these spiders are mostly found loitering on the ground upon dead leaves and weeds. But in East Bengal these spiders are generally found on a kind of small plant where the red-ants are abundantly seen in company with a kind of plant-lice which attach themselves upon twigs and stems. Here my observations are slightly different from those of Major Hingston, who says:—'Amongst the leaves it makes a silk shelter from which it emerges to attack the ants'.[2] In numerous cases I have observed the spiders wandering about the lines of ants awaiting a chance to prey upon them without emerging from a neighbouring silk shelter.

In regard to the place of retreat of this particular mimicing spider, my observations are also different from those of Major

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[1] K. Narayan, 'Notes on Ant-like Spiders of the Family Attidae in the Collection of the Indian Museum', *Rec. Ind. Mus.* xi, p. 396 (1915).

[2] Hingston, Major R. W. G., 'Field Observations on Spider Mimics', *Proc. Zool. Soc. Lond.*, pt. ii, p. 846 (1927).

Hingston.[1] The male and female of *A. forticeps* hardly shelter in any retreat except during the breeding time when the female makes an ingenious nest by folding a small leaf lengthwise and securing it by three stitches, one in the middle and two at the extreme edges. Inside the fold the female spins a round patch of white silk in which she lays about 15 to 25 yellowish globular eggs enclosing them once more in a white sheet of silk. (Fig. 2). The female spider sits upon the eggs and never goes out for about 15 days till the young ones are hatched. The young spiders do not leave their shelter for 5 to 6 days after hatching.

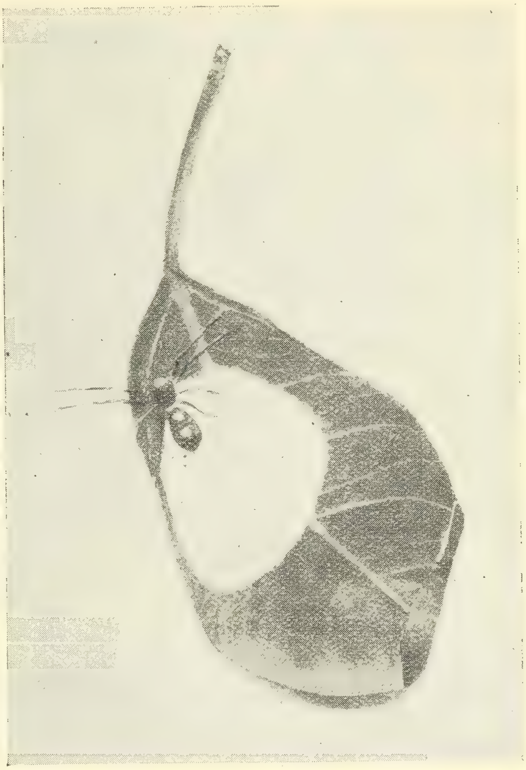

FIG. 2.—On the unfolded leaf, the female spider is seen sitting on her eggs.

The young spiders are quite different from their parents in colour, markings and other characteristics, as happens in most other classes of spiders. The colour of the mature spider is brick-red all over except the tarsal joints of the 1st. and 2nd. pairs of legs which are white. But these young spiders are light green all over with several prominent reddish-violet or crimson-red bands all over the first two pairs. Specially the femoral portions are thickly banded. The bands on the 3rd. and 4th. legs are less prominent. The two posterior abdominal spots gradually appear after 3 or 4 moultings.

During pregnancy, the female appears quite different from its normal condition. Naturally the abdomen is elongated with a wide dorsal depression in the middle, measuring about 1.2 mm. in width. But in pregnant condition, all the blackish shades and depressions disappear and the two black spots on the posterior portion of the abdomen become broader and more striking. The shape of the abdomen becomes somewhat triangular and truncated at its posterior end, rather than oblong; from one spot to the other the distance is about 3.5 mm. (Fig. 3.) The colour is now changed into a light yellowish orange, on which account they may be mistaken as belonging to a different species.

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[1] Ibid., p. 846.

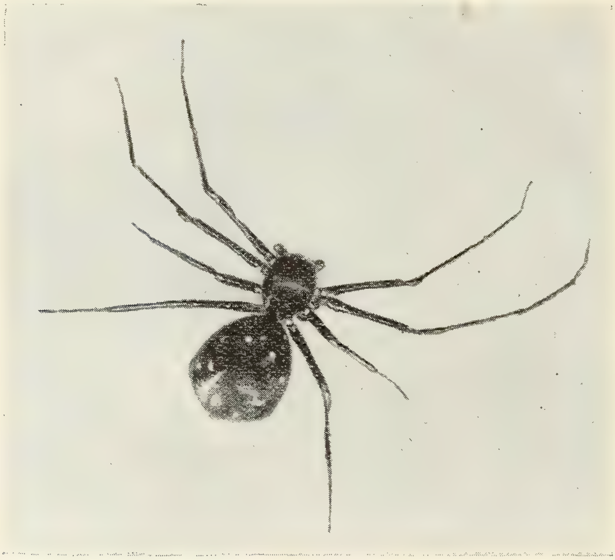

FIG. 3.—Enlarged photograph of *Amyciaea forticeps* (gravid female).

As in most spiders of the family *Attidae*, and some of the other families, these mimics have two accommodating eyes. From numerous observations I am inclined to think that the power of vision, in several species of spiders of different families, such as *Thomisidae*, *Attidae* etc., is restricted to one pair of eyes only; the rest of the eyes may be of little or no use to them. In using the word 'accommodating' for this particular pair of eyes, it is meant that the spider can adjust the cones within the eyes for vision at different distances and at various angles. The anterior median pair of eyes of *A. forticeps* which are much smaller than the four lateral ones, are accommodating. They can adjust the inner retinal cones (or cone-like sacs) of these two accommodating eyes at will so as to have a clear and perfect vision. Mr. Mathew writes in a recently published article about the changing of colour of the eyes of a spider (*M. plataleoides*).[1] This phenomenon was also observed by Mr. T. Padmanabha Pillay, Trivandrum, and published in *Nature*, Vol. 68 (1908). I have, however, succeeded in observing different species of spiders having acquired these peculiar characteristics of moving their internal retinal cones of only one pair of frontal or median eyes. In some cases these accommodating eyes are bigger and in some cases smaller. In the case of *A. forticeps* it is the smaller pair of eyes.

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[1] Mathew, A. P., 'A Spider that Changes the Colour of its Eyes at Will', *Jour. Bom. Nat. Hist. Soc.*, xxxv, No. 1, p. 132 (1931).

Owing to the predatory habits they often lose most of their appendages and crawl with the help of pedipalps or remaining one or two legs. Notwithstanding the timid habits of *A. forticeps*, the bigger *M. plataleoides* are no match for them and they are often defeated and become crippled in the short struggle.

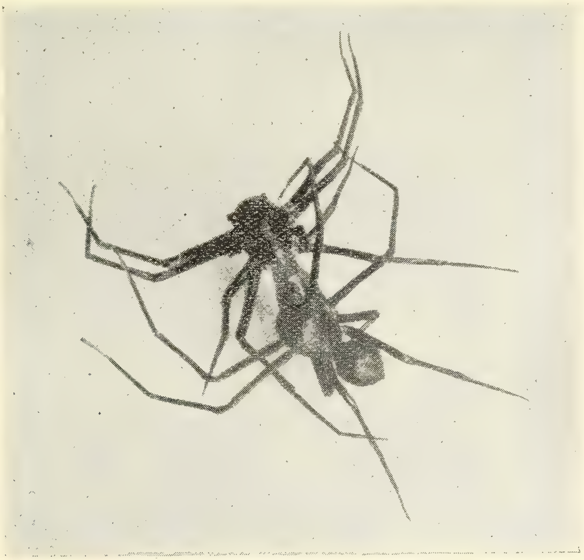

FIG. 4.—Mating of *A. forticeps*.

The mating habits of these spiders are different from those of other mimics. Before mating both of them display their graceful movements of legs. The male comes upon her back from behind and rests his head in the same direction as that of the female. (Fig. 4). This position being unlike the ones observed in other spiders. A detailed account of mating of these spiders will be given in a subsequent paper.

GOPAL CHANDRA BHATTACHARYA.

93, UPPER CIRCULAR ROAD,
CALCUTTA.
*September*, 1932.

## XXII.—A HUNTING WASP AND TRAP-DOOR SPIDER.

I was returning from my usual evening ramble watching birds, when my attention was drawn to one of the hornet-like insects alighting on the ground but a few yards away. If to know the Latin names of each and every bird and insect is essential before calling oneself a naturalist, then I do not come under that category, but can only be a lover of Nature. The wasp in question is not the mud wasp who makes mud nests in my library, stocked with green caterpillars, but a bigger species with a black metallic body, yellow legs and conspicuous brown sienna wings tipped with black which when closed she flutters at intervals the action reminding one rather of an agitated lady tapping herself with her fan. She landed on an open space alongside the cart track, her wings vividly contrasting with the ash coloured earth and at once began a search amongst the pebbles. Back and forth she hunted much like a gun dog so that my interest was aroused as to what was the object of her search. The time was then 5-55 p.m. She crossed the track just in front of me without a pause and continued her search on the other side where there was a small cactus alongside a small toddy palm and a few isolated tufts of coarse grass. At intervals the wasp momentarily paused, gave a few agitated flaps to her wings, and then resumed her search, sometimes forcing her way through patches of grass which must have towered above her like palm trees. The hunt continued till 6-10. By then I had made up my mind that it could not be for any class of mud she was searching it must be for food. At last, quite near the small cactus she paused, not 18 inches from my boot. It was a little open space between small tufts of grass and alongside one small white quartz pebble. Suddenly she savagely tore at some small scraps of grass, as if to clear a space, then suddenly appeared to lift something which at the time I imagined was a small clod of earth and tried to wriggle under it, lying on her side. Twice she failed in her attempt and came out from under what I still thought to be a clod of earth and stood as if contemplating. I now thought I was watching the wasp starting to make a new nest, though it seemed very late in the evening to start on such a big task. Again the struggle with the clod of earth commenced, and now I was on my knees, and realized I was witnessing a case of day-light house-breaking, and that the object of attack was not a clod of earth, but the flap door of a trap door spider's nest. Now I was nearer and with the aid of my eye-glass I was able to better realize what was happening. The wasp struggled to lift the trap door and again got on her side, at intervals thrusting in her sting beneath the lid. Suddenly she disappeared under the trap door of which presumably the spider had relinquished her grip and retreated down the tunnel. The spider must have fought her ground inch by inch and sometimes proving the stronger, for occasionally the trap door fluttered, showing the wasp had been forced to retreat. It was now 6-25 and past sun-set.

Curiously it was only the previous day that I had been reading Alexander de Mattos' translation of Fabre's *Life of the Spider* and the fights between the bee and the Tarantula. But here I realized was an entirely different case going on right below my feet, for had not I watched the wasp for half an hour searching for the trapdoor, like a dog hunting for truffles. And so the wasp's attack must have been deliberate, planned with malice and aforethought, an incident of her daily life of house-breaking and murder. Ten more minutes passed and no sign of anything on the surface, and now as dusk had come I got a screw driver and an electric torch from the car, for I couldn't go home without knowing who had won the fight. Carefully I lifted the trap whose edges were only just visible with the aid of my eye-glass held to get the greatest magnification, and poked a piece of grass down the hole. At less than 4 inches I met an obstruction and a moment after the wasp appeared, very agitated, flapping her wings, and at first stood alongside the trap door. Having been stung once by one of these infuriated ladies I rose from my knees. I rather hoped the wasp intended to renew the attack, but after most carefully dusting herself and walking up and down as if to sum up the pros and cons of the situation, she flew away. I waited a few minutes with the hope that the spider would regain hold of the flap of the door, then lunged the screw driver into the earth at an angle, as advised by Fabre, but only succeeded in extracting the top section of the trap door spider's nest, luckily with trap intact which is on the table before me as I write.

The measurement of the sloping tunnel is just ½″ in diameter. This I imagine would have made the fight fairer, for I do not think the wasp which is at least 1¼ in. long could have brought her sting into play in such a confined space. So during that quarter of an hour those two ladies had been fighting cheek to jowl like a dog and a badger.

This is the first time I knew trap door spiders lived in India. E. H. A. does not mention them. I have studied them in the Murchison district in West Australia, and there their main enemy is a lizard, which burrows down incline shafts to attack the colony. To circumvent this, the spiders build a ring of dummy holes at a small distance around the inhabited colony, to delude the lizard, and make him waste his time in abortive mining.

If all trap door spider's nests in India are like the one before me, I defy anybody without microscopic examination of each inch of ground to find them. The trap now, even after the camouflaging grass has been removed by the wasp, and the edge of the trap slightly bent by the screw driver, is quite indistinguishable to the naked eye from the surrounding earth. To follow up my search it seems the only thing to do, is to watch the movements of the brown sienna winged wasp, who may have discovered the nest by smell. But it is unwise to jump to hasty conclusions when studying insect life.

LINGSUGUR, L. MUNN,
RAICHUR. *Capt.*
*September* 12, 1933.

[The Wasp to which Capt. Munn refers is a Pompilid species known as *Salius flavus*. It is a common yellow insect with yellow wings which are deep purplish black at the apex. It nests in the ground, and its usual prey is spiders. The huntress lays her eggs in the Spider's body after rendering it comatose with its sting. For this purpose it is usually seen busily searching the ground for spiders with great patience. It moves quickly on its long limbs and its occasional flight is very graceful to look upon. Combats between spiders and this wasp are frequent. The spider usually emerges from its hole and stands at bay with erect cephalothorax and jaws (with the poison fangs) wide open. Its action is entirely defensive. There is a series of tactical movements displayed by the Wasp. It seems to realise the capacity of the death dealing jaws of its antagonist. She approaches with the greatest caution, turns round and round, the spider doing the same, always facing its attacker. The wasp however appears to know the weak point of the spider, namely its inability to strike upwards. She therefore seeks an opportunity to jump on the spider and with a clever and agile leap, alights on its back. It applies its sting, first paralising its victim's poisonous weapons from below. It stings again thrusting its lancet along the side of the cephalothoracic shield which covers the head and chest of the spider. The victim is thus paralised and the fight ends. *Salius flavus* is never found frequenting houses as it almost exclusively confines itself to catching ground spiders.

Dr. Gravely has written a popular article on Indian Spiders in the *Journal* of the Society, vol. xxviii, p. 1045, in which he refers to the Trap-door Spiders.—Eds.]

## XXIII.—A MEANDER THROUGH THE CINCHONA PLANTATION.

One bright and clear day during a break in the monsoon, we motored to the western area of the Cinchona Plantation. Our way led us through the Ipecacuanha nurseries where men were trimming and planting rooted cuttings, each in its own little place, in long even rows. Ipecacuanha is a small evergreen plant from the roots of which Emetine is extracted. It is of great medicinal value, especially in the treatment of Dysentery.

The pathways, which in the dry weather are baked hard, were covered with tiny ferns and grasses, and around us on the hillsides arose tall forest trees, and those near the stream on swampy ground, were covered from root to top with Screw Pine, the adventitious roots of which were securely fastened to the tree, giving the tree, at a distance, the appearance of being covered with strips of green ribbon.

We continued our way through the virgin forest keeping a good lookout for snakes, which have a habit of basking in the sunlight, or on the warm grass almost unseen. My husband had a bad shock sometime ago. He trod on what appeared to be dried rubbish, but which concealed a Cobra, and in a flash an arc of fury appeared. With the instinct of self preservation which dwells in all living creatures, my husband saved his life by lowering a large Chinese umbrella which he was carrying, and which caught the vicious stabs, before the reptile vanished down the hillside.

The forest was rich in vegetation which is never seen in the dry weather. Creepers of all shapes and sizes were climbing the trees, joyous and green, all in a hurry to reach the top of the tree and sunlight.

Clumps of bird's-nest ferns, orchids, which later will give yellow, white, mauve, and pink flowers, and many other epiphytes and ferns, covered the branches and treetops.

The huge buttresses and boles of large trees were turned into fairy gardens, and were covered with mosses, lichens, tiny ferns, and dainty Begonias with heart-shaped leaves and pink wax like flowers. Occasionally a tiny stray Begonia would be in flower quite fifteen feet up a tree.

From the rank undergrowth many flowers pushed their heads. Here a splash of red Ixora, a white Polygonom with dainty spike-like sprays of flowers, reminding one of the Lily of the Valley, a creeper with hard purple balls of flowers lying close to the stem, and on the ground a plant with variegated leaves and flowers both mauve and violet, it has no perfume but we call it the violet.

We emerged into the bright sunlight and the Cinchona Plantation. The wonderful febrifugal quality of the bark is well known, but it is a very delicate plant to grow and needs much care and attention.

The trees were in flower and the air was filled with a perfume like new mown hay. Under our feet the path was covered with springy grass among which grew tiny Oxalis and Vandelias. The dew still glistened on the grass and where it lay upon a cobweb, the cobweb was transformed into a shining gem of exquisite workmanship.

In the crevices and crannies of the banks were Selaginella, mosses, lichens, and fungi. We found one lovely specimen of Lycopodium climbing a tree, it was quite a yard and half in length. There were fresh depressions in the soft ground of a Bison's feet, for the jungle folk still wander in their old haunts.

Around us was Cinchona of a hybrid type, and as the leaves seldom come true to either of their parents they were of a great variety. Some had shiny dark green lanceolate leaves, others were much larger and broader, twice the size of the first, of a lighter green, traversed with brilliant crimson veins and stalks of the same colour. Between the two, leaves of many shapes and sizes.

The flowers were both pink and white. Large panicles of tiny flowers some of which had gone to seed. The seed pod is cylindrical, about half an inch long, containing numerous tiny light seeds, many thousands of which go to make an ounce.

In Bengal, Cinchona is grown at an elevation of between 2,000 ft. and 5,000 ft. Here it is grown between 200 ft. and 1,000 ft. and climatic conditions are very different. Shade trees are necessary during the heat of the dry weather, so with a view to shade, manure, and when the Cinchona is uprooted, to reafforestation, several varieties of forest trees are planted. *Gliricidia maculata,* which in the spring is a mass of sprays of pinky mauve blossoms springing from its bare branches, *Erythrina indica, Grevillia robusta, Pyinkado,* the Ironwood of Burma, Rubber, Cassia with yellow scented sprays of flowers. All are intermingled with Cinchona and make one large garden, through which several miles of road and path meander.

Quite near we heard the tap-tap-tap, of wood upon wood, and the murmur of children's voices, we are near the object of our walk. There in the shade of the trees sat the children each upon a sack, with a quantity of small washed broken branches beside each. In front a long basket lying on its side, with its opening towards the child. The piece of Cinchona to be barked is placed upon a small block of wood and the bark knocked off with a small wooden mallet, and scraped with a blunt knife into the basket.

We continued our way uphill, butterflies darted around, the air was filled with the cheerful buzz of insects, all nature rejoiced at the sunshine after so much rain. A breeze swayed the graceful branches of the Gliricidia and made the Silver Oak leaves dance.

At last we were at the top of the hill, and what a view met our eyes! Although only about 600 ft. up we appeared to be on the edge of a gigantic green basin, with a dip towards the west. All around us were range upon range of evergreen forest. Looking before us in the distance, dark green of virgin forest, on a ridge in the middle distance the Doctor's house and hospital, among the bright green of the *Phaledo*, our house on the next ridge among the darker green of the rubber, a patch of bamboo jungle, then a strip of dark forest descending to the valley. To our left at the very bottom of the basin were the workshops, houses, bazaar and a large tin mining dredge all looking like tiny toys in the bottom of the enormous green bowl.

We turned our steps homewards, and were glad to dip once again into the forest, away from the sun. In the cool shade the small tree stumps were covered and made beautiful with a tiny climbing *Ficus*. A *Cycas revoluta* stood among the jungle. One of the oldest known plants, found in fossils all over the world, yet growing in its natural state here. We found a cluster of double seed-pods ,two pods joined together formed miniature Ram's Horns. Then a small black tree stump with a filigree of dainty lace in pure white lichen.

A sound in the jungle! and the calling of monkeys not far away, and away dashes the dog, regardless of our calls, forgetful that only last week he and his mate dashed into the jungle, then a snarl! A yelp! and only he returned very frightened and subdued. A hunt yielded the remains of his poor little pal. She must have rushed straight into the leopard.

At last we were among the coolie houses which are built of the ever useful bamboo, and roofted with dhani palm, lifted about 4 ft. above ground on posts, and each having some cultivation, chief of which is the *Manihot utilissma*, with digitate leaves on long red stalks. The root gives a kind of yam, is used as a vegetable and has a slightly bitter taste. It is ground into flour for bread, and is often fermented and made into a drink much appreciated by the coolies. Many chubby children, some quite naked, played in the sunshine, among the dogs, goats, and hens.

We climbed again through the rubber to our house and the perfume from the Frangipani welcomed us home.

Government Cinchona Plantation, Mrs. P. T. RUSSELL.
Mergui, Lower Burma.
*September* 21, 1933.

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*Continued from Vol. XXXVI, No. 4, of the Journal of the Bombay Natural History Society.*

# THE WILD ANIMALS OF THE INDIAN EMPIRE

AND THE

# Problem of their Preservation

## Part II.

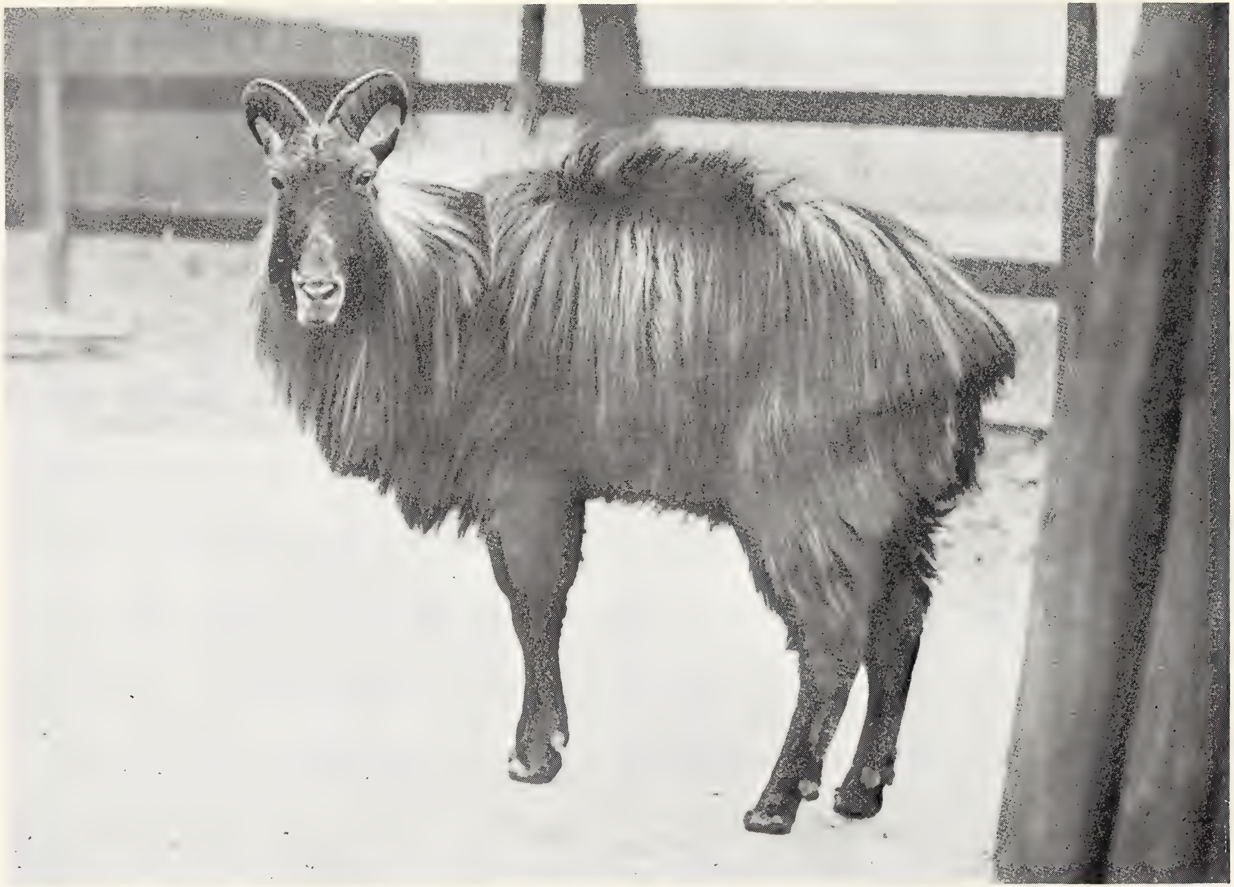


Photo by F. W. Bond.

The Himalayan Thar (*Hemitragus jemlaicus* H. Smith).

(*Height at shoulder 36-40 in.*).

# THE HIMALAYAN TAHR (*HEMITRAGUS JEMLAHICUS.* H. SM.).

The Tahr does not compare well with his big-horned relatives the Ibex and Markhor. It is a wild goat with a finely formed head, narrow erect ears, a heavy body and long robust limbs. A well grown male stands from 36-40 in. at the shoulder and scales near 200 lbs. While the hair on the Tahr's head and face is short its body is covered with tangled masses of coarse, flowing hair. It grows longest on the neck and shoulders where it develops into a mane which sweeps down to the knees. An old buck poised on some precipitous cliff presents a grand picture. The colouring is very variable. Generally it is a deep reddish brown and there is a dark dorsal streak—not always distinct. Old males are darker, particularly about the back and quarters. Ewes and young males are lighter brown; kids much paler.

The horns are short and close set. They are stout at the base, keeled in front and wrinkled, except towards the tips. They curve backwards and in old bucks continue downwards. They are about 15 in. in length with a circumference of 10-11 in. at the base. The record measures 16½ with a girth of 10½. Females are smaller in build. Their horns are dimunitive. They are easily recognised by their lighter colouring and less shaggy coats.

Tahr live in a precipitous terrain of towering cliffs, rock and forest. Because of the difficult country they inhabit, it is said that few Himalayan game animals so tax the skill and endurance of the hunter.

About March and April before the snows have melted, Tahr crowd into the bottoms of the valleys. In summer, the older males herd together or live singly. They frequent the densest undergrowth and the most precipitous cliffs. They rejoin the females in late September or October. During the rutting season the males are always fighting and many are said to be killed by falling down the crags.

Tahr feed in grassy spots among rocks. If alarmed they go off with great speed and clatter but soon halt and turn to stare at the intruder. They generally follow the guidance of an old male and seek security in the almost perpendicular precipices. Their sense of sight and smell are both keenly developed. The range of the Tahr includes the Himalayas from Kashmir to Bhutan but does not extend to the northern side of the Vale of Kashmir. Tahr are common on the southern slopes of the Himalayas but do not occur on the Tibetan side of the range.

## THE NILGIRI TAHR (*HEMITRAGUS HYLOCRIUS* BLYTH).

Frequently misnamed the Nilgiri Ibex, the Nilgiri Tahr is a near relative of the Himalayan species. It is slightly larger than the Himalayan Tahr, standing 39-42 in. at the shoulder. Its short crisp coat, the rounded outer surface of its horns and the presence of only a single pair of teats are other distinguishing characters.

The general colour of the animal is a dark yellowish brown, paler on the undersurface. Does and young bucks are grey. With age the bucks get a very deep brown—almost black coat with a distinctive light 'saddle' patch on the loins. From a distance the saddle looks almost white. In build bucks are far heavier and sotckier than the does.

The horns, almost in contact at the base, rise parallel for some length then diverge and curve downwards in a bold sweep. They are deeply wrinkled. The knotted keel in front, so distinctive in the horns of the Himalayan Tahr, is absent. The record buck horns measure $17\frac{1}{2}$ with a girth of $9\frac{7}{8}$ in. The record doe 14 in. Nilgiri heads are small in comparison to those found in the more southerly ranges.

Nilgiri Tahr live on the open cliffs and when alarmed take shelter on the precipitous slopes. They feed in flocks on the grassy downs which top the summits, grazing in the early morning or late afternoon and resting during the hot hours of the day. One or more does stand sentinel over the resting herd. While exceedingly watchful against any danger approaching from below, they are frequently outwitted by the enemy from above. Panthers levy the heaviest toll on the herds.

During the south-west monsoon Tahr generally move down to lower elevations. Old bucks desert the herds during the hot weather and, more often than not, are found solitary. Tahr sometimes have two young but one is more usual. The kids are dropped most commonly during the hot weather.

The isolated distribution of this wild goat so far south of the usual range is interesting and is taken to indicate the existence at some remote epoch of the earth's history of conditions which enabled Tahr to inhabit the country now lying between the Himalayas and the Nilgiris.

Strict preservation has saved the Tahr from extermination in the Nilgiris. From these hills its range extends to the Anamallais and thence southwards along the Western Ghats.

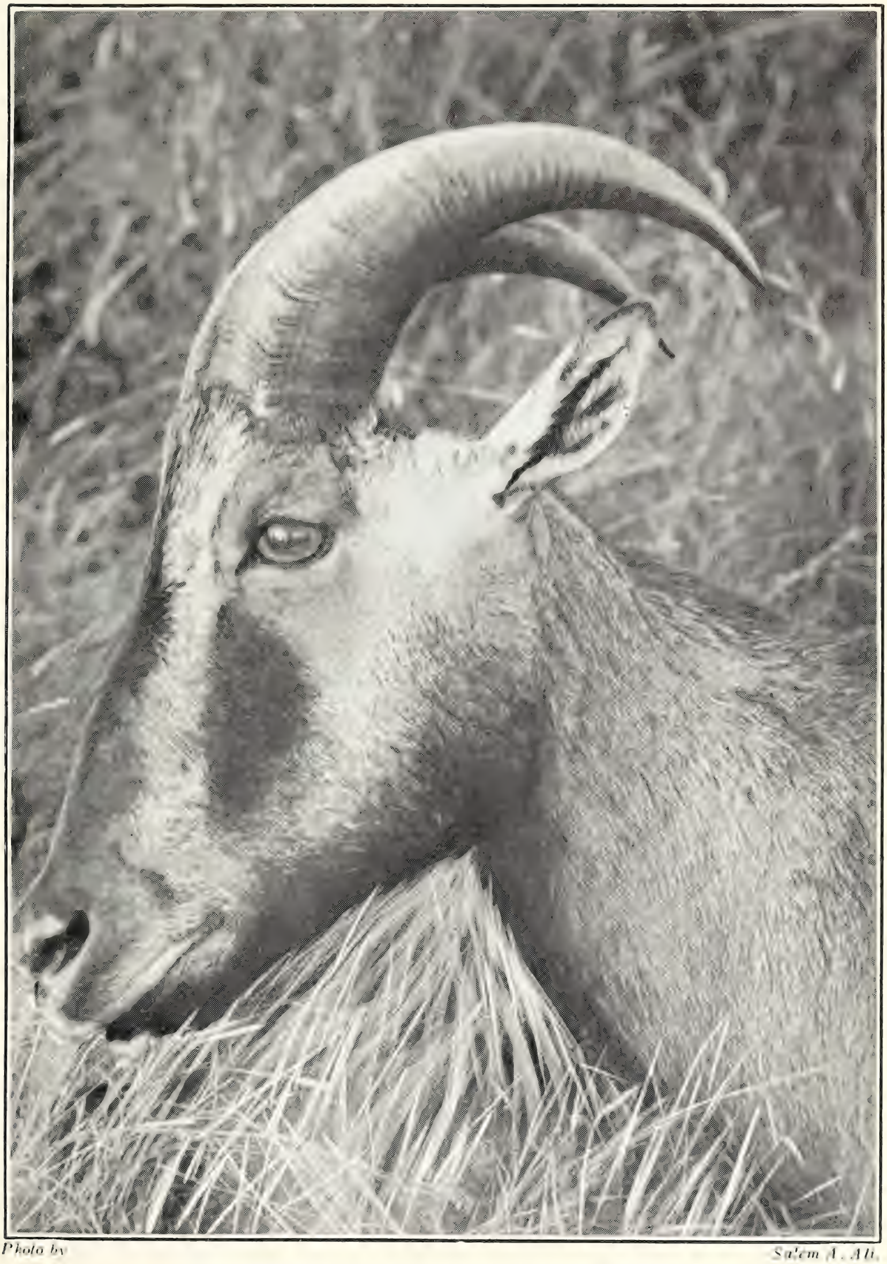


*Photo by* *Salem A. Ali.*

The Nilgiri Thar (*Hemitragus hylocrius* Blyth).

(*Height at shoulder 39-42 in.*).

## Sub-Family III. *Rupicaprinae*: GOAT-ANTELOPES.

### Serow, Goral and Takin.

The Goat-Antelopes are said to hold an intermediate position between the Goats and that heterogeneous assemblage of animals collectively known as 'Antelopes'. All of them are mountain animals. Most have a more or less goat-like build, goat-like teeth and short tails. Relatively small cylindrical horns are present in both sexes.

Serow, Goral and Takin belong to this group. It also includes the Chamois (*Rupicapra*), the type which gives its name to the group, and the Rocky Mountain Goat of North America.

Serow and Goral have distinctive conical horns. They curve backwards and have not the terminal hook seen in the straight horns of the Chamois. Though there is a superficial resemblance between them, Serow and Goral differ much in the structure of the skull. Further, unlike Goral, Serow have well-developed face glands which rest in a depression in the skull. The gland opens with its small orifice in front of the eye. At times the opening looks like a small sore. It exudes a whitish secretion which, when dry, has the consistency and smell of gum arabic. Serow have a strong goaty odour. As in sheep and goats it appears to come from the surface of the skin and not from any special glands.

Goral are much smaller animals than Serow. They have no face glands but are furnished with foot glands similar to those found in sheep. These glands open by a small orifice in front of the pastern, above the hoof. It is not known whether Serow have them. Strangely enough, in the structure of its skull, the Goral approaches the Takin. A kinship is here suggested which one would not easily suspect from the widely different appearance of these two animals.

The Takin is a large heavily built, aberrant form of goat-antelope. It lacks that lightness of limb and body to which Serow and Goral owe their agility. The horns, which are thick and nearly in contact at the base, grow outwards, downwards or forwards and then take an abrupt curve upwards or backwards in the same direction as the plane of the face.

## THE SEROW (*CAPRICORNIS SUMATRAENSIS* POCOCK).

With its large head and donkey-like ears, its thick neck and short limbs the Serow is an ungainly creature. Its habit of standing with its forelegs astraddle, the hoofs widely splayed and the head thrust downwards adds to its awkward appearance. Both sexes are similar in build. A full grown Serow is from 36-38 in. at the shoulder and scales from 170-200 lbs.

The coat is coarse and rather thin in Serow which live at lower elevations. Its colour varies so much that it is difficult to describe. It ranges from grizzled black or blackish grey-roan to red. In the darker animals the head, neck and the mane, which covers the nape and withers, is grizzled black. The black passes into rusty red on the shoulders, flanks and lower thighs and turns a dirty grey on the inside of the limbs and belly. There is a varying amount of white on the muzzle, throat and chest. In the Chin Hills and Arakan a red race of Serow (*C. s. rubidus*) occurs. In the Himalayan races the limbs are chestnut above and dirty white below from this there is a transition to the Malay serows in which the limbs are wholly black.

Horns are common to both sexes. They are black, conical and closely wrinkled for three quarters of their length. They run to 10 or 11 in.

In the Himalayas the Serow favours an elevation between 6,000 to 10,000 ft. In the Burmese hill ranges they may be met with at a height which varies from 700 to 8,000 ft.

Serow live in the recesses of thickly wooded gorges whose boulder strewn slopes and shallow caves give them shelter from the weather. In the mornings and evenings they come out to feed on the rank herbage of the more open slopes. They are more or less solitary creatures though four or five may be seen feeding on the same hill. Their movements belie their awkward appearance. They are exceedingly active animals, not only on rock but also on flat ground. When disturbed, serow dash away with a hissing snort. Their call is a whistling scream. The female usually has one kid at birth, sometmies two. In the Himalayas the rut commences at the end of October and the young are born in May and June. In Burma the young are born about the end of September. The period of gestation is said to be about 7 months.

Serow range from the Himalayas to the mountains of China and southwards through Burma and the Malay countries. They are also found in Formosa and Japan. Eight races have been described from British India and the Strait Settlements all localised forms of a single variable species.

PLATE XVII.

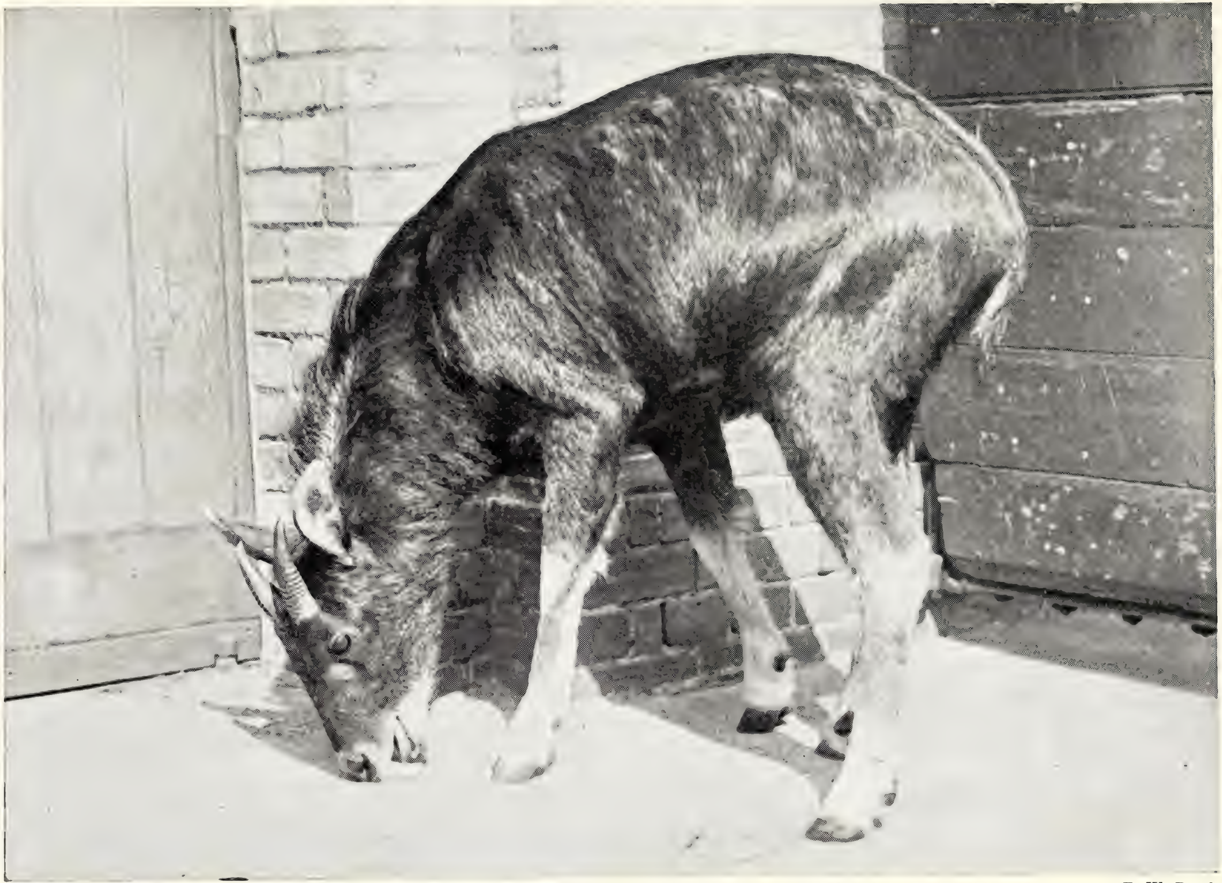


Photo by F. W. Bond.

Serow or Goat-Antelope (*Capricornis sumatraensis* Pocock).

(*Height at shoulder 36-38 in.*).

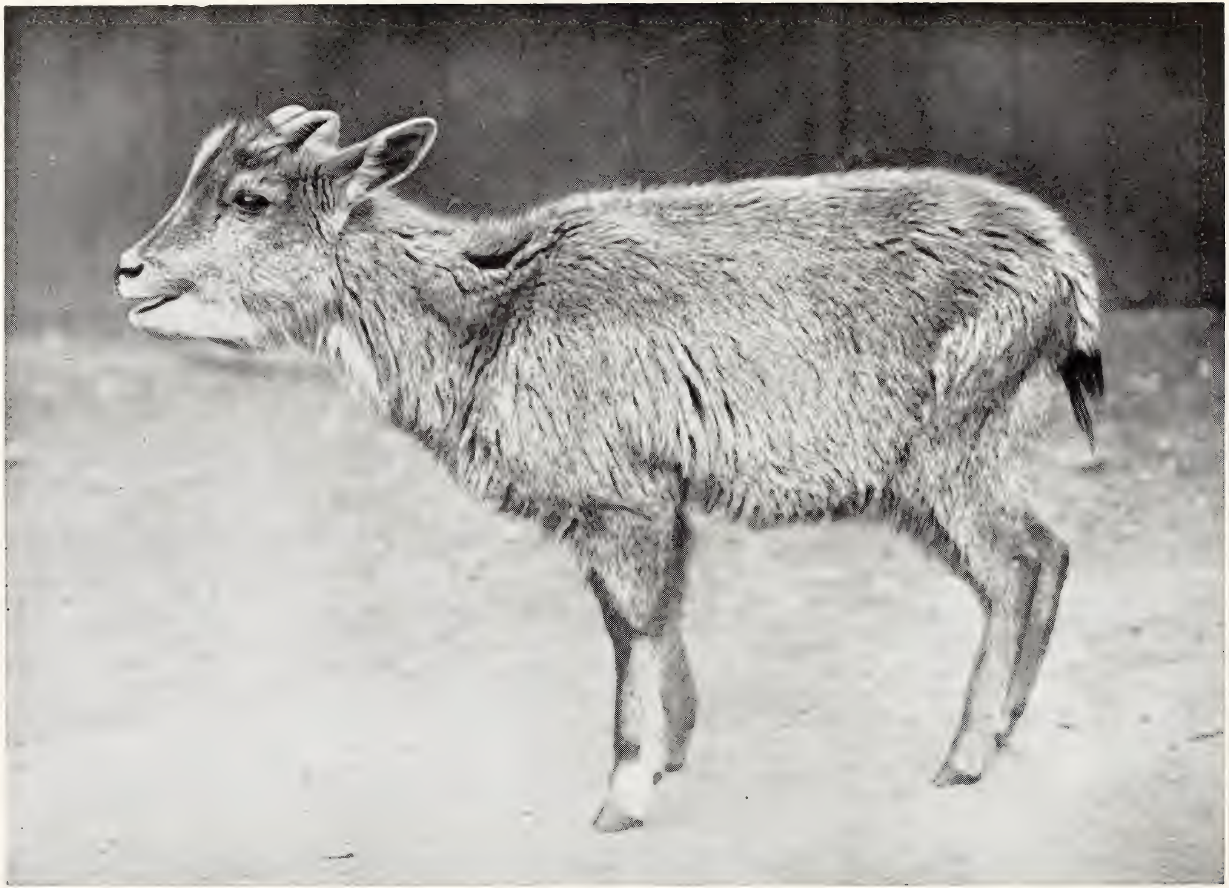


*Photo by* *F. W. Bond.*

A young Goral (*Nemorhaedus goral* Hardw.).

(*Height at shoulder 26-28 in.*).

## GORAL (*NEMORHAEDUS*).

Three species of Goral are found within the Indian Empire:—The Grey Himalayan Goral (*Nemorhaedus goral* Hardwicke) of Kashmir and the Western Himalayas, the Brown Goral (*N. hodgsoni* Pocock) of Nepal and Sikhim, and the Burmese Goral (*N. griseus* Milne-Edwards) found in Burma, Eastern Tibet and Southern China.

The Goral is sometimes called the Himalayan Chamois. It has little in common with the Chamois and is distinct in the form of its horns, and the colouring and shagginess of its coat. Its kinship with the Takin has already been suggested. The Goral is a goat-like animal standing about 26-28 in. at the shoulder.

The general colour of the Grey Goral is a yellowish grey suffused with black. Individuals differ, but no Grey Goral has the pale area of the hairs tinged with rufous or brown. The chin, upper lip, underside of the jaws and throat patch are white. The dark spinal stripe if present, does not pass beyond the withers. There is no stripe down the middle of the tail and none up the back of the thighs. The Brown Goral is distinguished by its golden or rufous brown coat, speckled with black. The black spinal stripe reaches to the root of the tail but tapers away and is indistinct on the croup. The tail is black above. A dark ill-defined stripe runs up the back of the thigh from the hocks.

The Goral of Burma is distinguishable from the two Himalayan forms by two main characters. The tail is larger; about 5 ins. long in the adult. The black stripe on the fore-leg does not pass over the knee as in the Himalayan Gorals but turns aside and runs down the outer side of the cannon bone on to the back of the fetlock.

Goral have short insignificant horns. They diverge slightly, curve backwards and are marked with rings or ridges for the greater part of their length. The record pair of Grey Goral horns measures 8⅞ in.

Goral frequent hillsides or rocky forest clad ground. They graze in small parties of 4-8 individuals. Old bucks are frequently solitary. In the Himalayas, Goral favour an elevation of 3,000-9,000 ft. though they may ascend to and have been observed at 13,000-14,000 ft. In the Arakan and Chin Hills, Goral are found above 3,000 ft. In Garhwal new born young have been observed in April.

## TAKIN (*BUDORCAS TAXICOLOR* HODGS.).

There are said to be three species of Takin:—The Mishmi Takin (*Budorcas taxicolor* Hodgs.), the Tibetan Takin (*B. tibetana* M.-Eds.) and Bedford's Takin (*B. bedfordi* Thomas). So far as is known the Mishmi Takin occurs in Bhutan Himalaya in the Mishmi Hills, on the Burma Assam Tibet frontier and in the Mountains of the Salween Irrawady divide. The Tibetan Takin is found in Eastern Tibet and Western Sze Chuan. Bedford's Takin in the Tsinling Range in Shensi, W. China. It is possible that the three forms are geographical races of a single species.

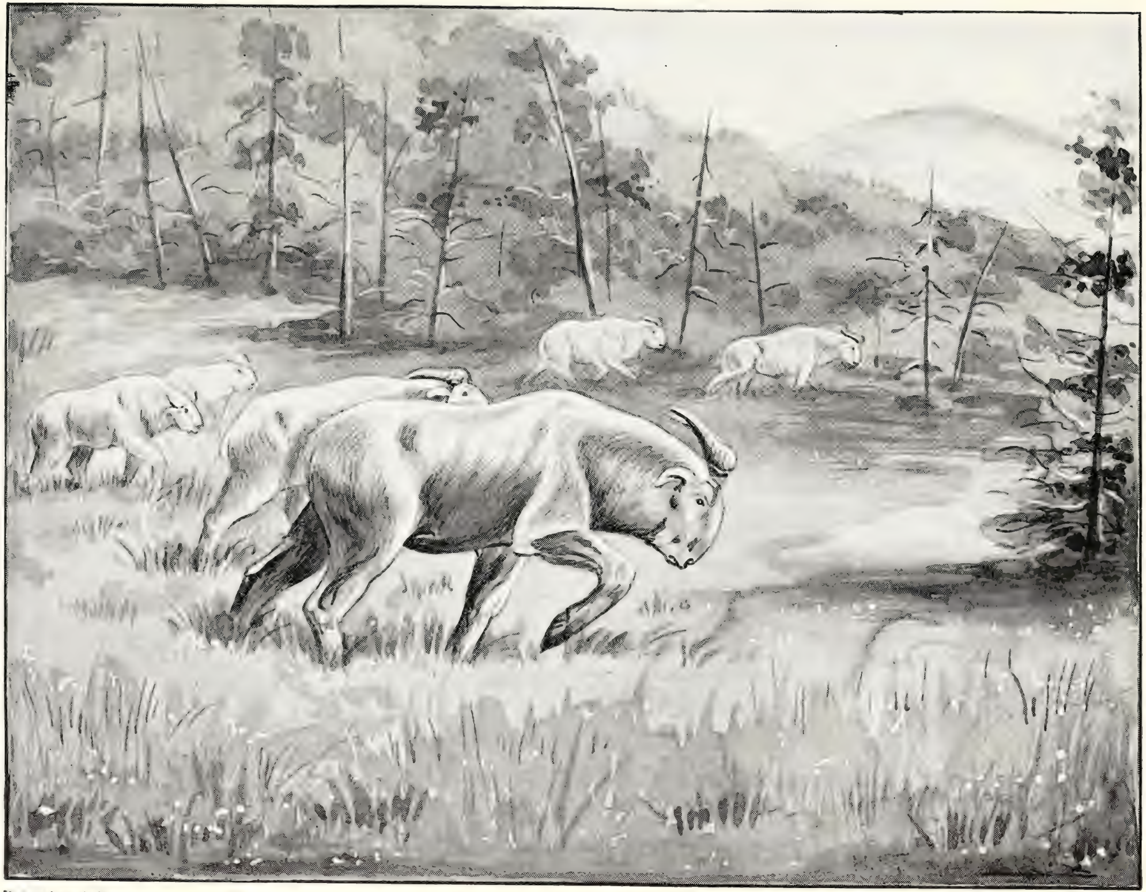
The Bhutan Takin is recognised as a separate race, *B. t. whitei*, because of its smaller size, darker colouring and smaller saddle.

The Takin is a clumsy heavy animal which from the shape of its horns looks as if it might have some relation to the gnu or musk ox, though there is no structural affinity between them. Its most striking feature is its immense convex 'face', heavy mouth and tremendously thick neck. The muzzle, except for a bare spot at the extremity is covered with hair. It is a character seen also in the yak and is probably associated with life at high altitudes, where the snow in winter has to be scraped away to get at the vegetation beneath. The Takin's heavy body is supported by exceptionally short, thick legs, thicker than those of a bison. Its withers are slightly raised and its narrow back arches in the centre and slopes downward to the root of the tail.

There is great variety of colour in Takin, ranging from dark brown to golden yellow. The withers are conspicuously lighter in tone. Adult males of the Mishmi Takin are golden yellow merging into dark brown or black on the flanks and quarters. There is a dark dorsal stripe. Young males are reddish brown in front merging into black. Calves all black. Females are greyer than the bulls with no trace of yellow. The dark dorsal stripe is inconspicuous in females and young males.

The horns of a young Takin grow straight up from the head with an outward tendency. Later they grow outwards and downwards. In the final stage the horns grow forwards, bend downwards and outwards with the points growing up.

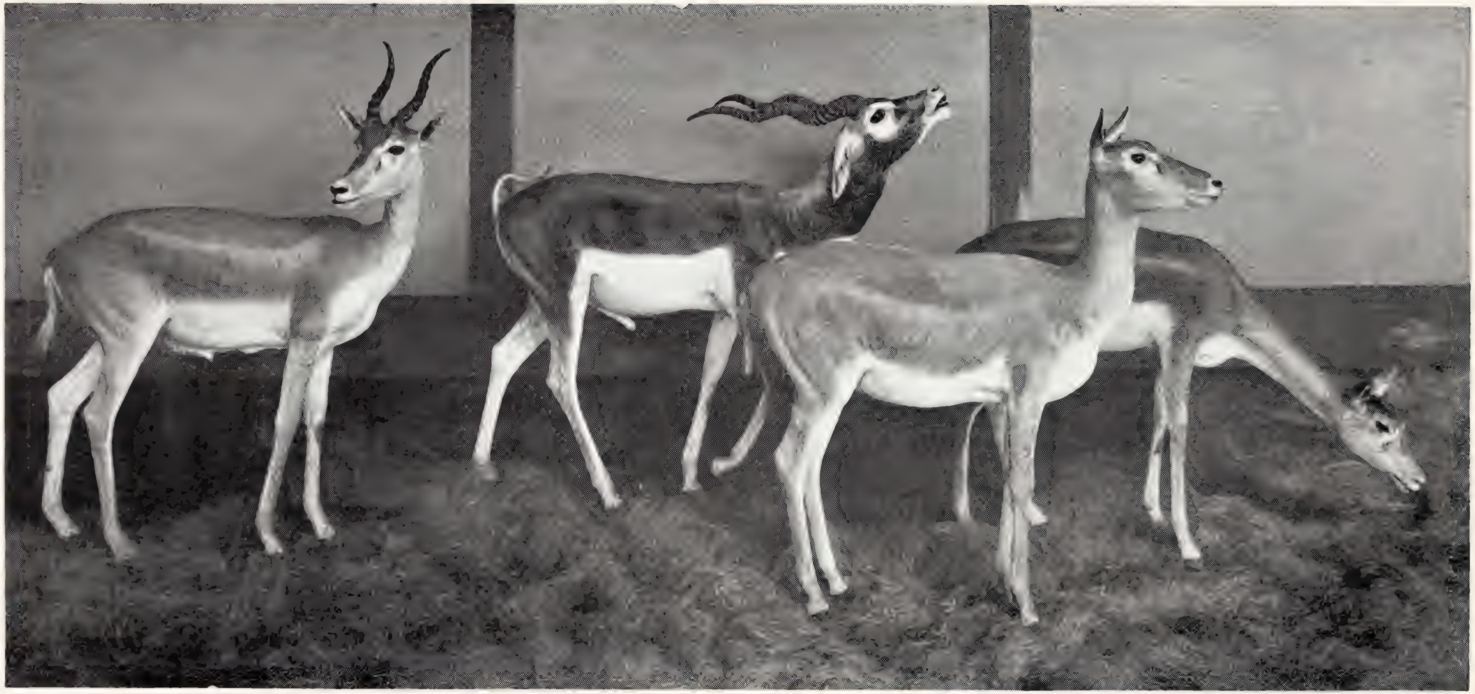
Takin live in the steepest and most thickly wooded declivities of their native mountains. In the Mishmi hills they have been seen in tropical forest as low as 3,000-4,000 ft. They are usually found in dense bamboo and rhododendron jungle at an elevation of 7,000-10,000 ft. In the summer months they collect in herds of considerable size as many as 300 have been observed congregated about a hot spring to drink. They went to cover at mid-day and came out in the late afternoon. In the winter the herds are said to break up into smaller parties. In Western China the rut takes place in July, August. The calves, usually one at birth are dropped towards the end of March or early in April.



*Reproduced from* *The Big Game of Central and Western China—Wallace.*

Takin ( *Budorcas taxicolor* Hodgson ) changing ground.

( *Height at shoulder: bull 51, cow 42 in.*).



*By courtesy of* *The Amer. Mus. Nat. Hist., New York.*

The Black Buck (*Antilope cervicapra*, L.).

## Sub-family IV. *Antilopinae*: ANTELOPES.

The Antelopes form an extensive group of ruminating ungulates which includes almost all the remaining members of the Bovine family. Although the term 'antelope' is in common use and though most antelopes are easily recognised, they are so numerous, so diverse in form that it is difficult to distinguish them as a whole from the oxen on the one hand and the goats on the other. They represent a transition between the two. Antelopes are the most generalised and oldest known representatives of the *Bovidae*. It is believed that the more distinctive and more specialised members of the family which we have so far described have been derived from them. In general, antelopes are light and graceful in build. Fleet of foot, they depend for their safety on great speed. Horns may or may not be present in both sexes. The bony core of an antelope's horn is nearly solid throughout and not honeycombed as are the horns of oxen. In the structure of their teeth some Antelopes resemble oxen, others, the sheep and goats.

Antelopes very generally have a gland beneath the eye, which distinguishes them from oxen and goats. The prominent glands below the eyes of the Indian Antelope or Black Buck attract the attention of most people. When closed the gland takes the form of a vertical slit of black, nearly hairless skin. This opens into a deep hair lined and perforated pocket into which the secretion of the underlying gland exudes.

It is difficult to surmise the exact function of these glands. They are present, as we have already seen, in other ruminants. They may have a sexual significance. They are particularly active in certain seasons and generally better developed in males than in females. But apart from this they may also serve as scent glands and, like the foot and other skin glands serve as a guide in keeping individuals of a herd together.

Antelopes are not nearly so well represented in India and Malaya as they are in Africa. If we exclude the widely spread group of gazelles the only Antelopes found outside Africa, Syria or Arabia are the Black Buck which is confined to India, the Saiga Antelope of Tartary and the Chiru of Tibet.

# THE CHIRU OR TIBETAN ANTELOPE (*PANTHALOPS HODGSONI* ABEL.).

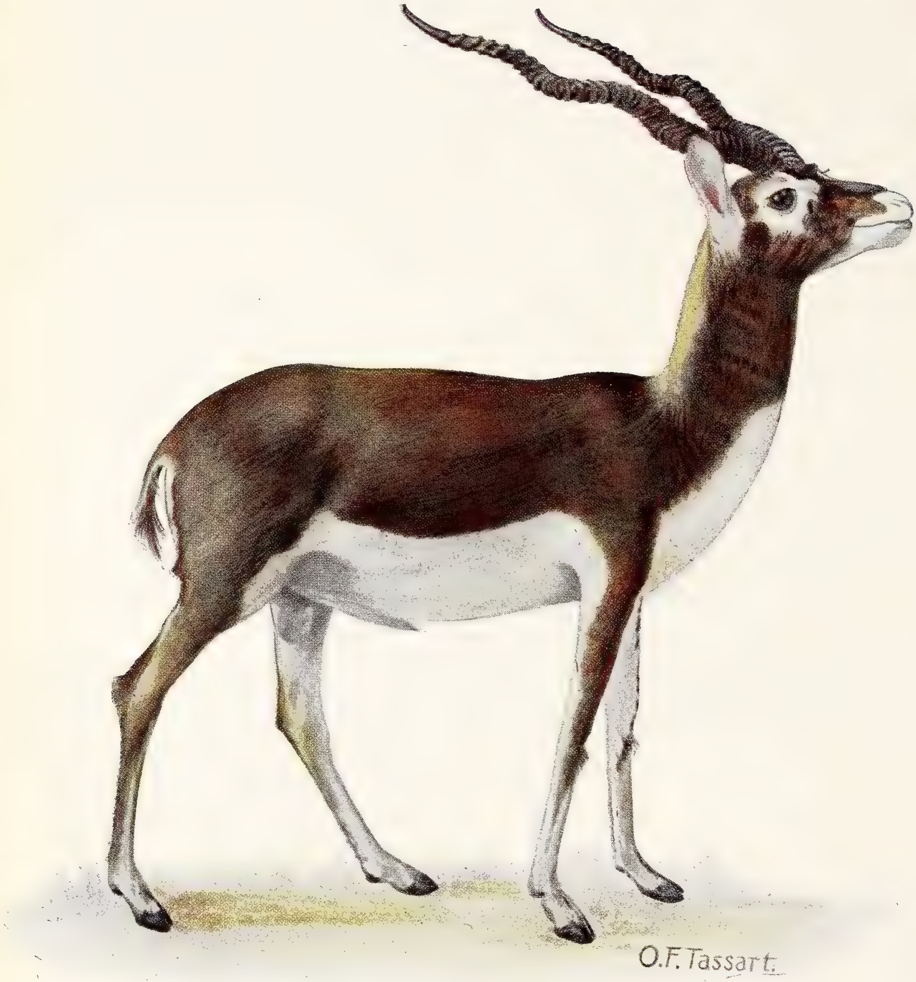
In the elevated and barren plateaux of Tibet there is a species of antelope which is remarkable for its curiously swollen snout and long, elegant horns. This is the Chiru, an antelope which is said to be the living prototype of the fabulous unicorn. Its long and slender horns, if seen in profile, may well suggest a unicorned animal. The Chiru is classed in a separate subfamily of antelopes —the *Panthalopinae* of which it is the only representative. The nearest relatives of the Chiru are the Saiga Antelope of Eastern Russia and the Impala of Africa. The Saiga carries to greater degree the curious snout development of Chiru. Its nose is inflated and prolonged into a downwardly bent, trunk-like proboscis. This inflation of the nose may have some connection with the high altitudes in which these animals live. At the side of each nostril, the Chiru has a large lateral chamber or sac whose function may assist breathing in the rarefied atmosphere of its native wilds.

Another peculiarity of the Chiru is the unusual development of the inguinal or groin glands. Perhaps the function of these glands, which are possessed also by other ruminants, is to scent the ground and so indicate to other individuals of a herd the place where one of them has rested. Chiru are known to lie up concealed in shallow pits which they scrape out for themselves in the sand. Large scent glands are also present between the fore and hind hoofs of the Chiru. It has no face glands.

The Chiru stands about 31-32 in. at the shoulder. Its body is covered with dense wool. The colour is variable. Generally it is pale fawn above and white below. The whole of the face and a stripe down the front of each leg is black or dark brown in the bucks. The horns of the bucks rise close together; they diverge towards the tips and curve slightly forward. They reach from 24-26 in. The record pair is 27$\frac{3}{4}$ in. Females are hornless.

Chiru live in the open rolling plains and the broad river valleys of the Tibetan Plateau, some 12,000-18,000 ft. above sea level. They may collect in large herds but it is more usual to find them in small parties of 3 or 4. They graze on the grass and small plants which grow on the open wind swept river flats. In summer the bucks live apart. The young are born in May and June. One young is produced at birth.

The Chiru is found only on the Tibetan Plateau. Its range extends north from the Chang-chenmo district of Ladak along the Nepal Tibetan frontier to the north of Tibet.



The Black Buck (*Antilope cervicapra*, L.).
( *Height at shoulder about 32 in.* ).

## THE BLACK BUCK OR INDIAN ANTELOPE (*ANTILOPE CERVICAPRA* LINN.).

The Black Buck is the sole representative of the genus *Antilope.*

Its striking colour, its beautiful spiraled horns, which may reach the shoulder height of the animal, give it an elegance hardly equalled by any antelope. This exclusively Indian animal is perhaps the most beautiful of all its tribe.

A well-grown buck stands about 30 in. at the shoulder and on the average weighs some 80 lbs. When young, its coat, like that of the does, is a yellowish fawn. When 3 years old it commences to turn black. This darkening of the coat varies in intensity. In South India the adult buck is rarely black, his coat remains a dark brown. Well matured brown bucks may again be seen in all parts of the country. In general there is a fading in the richness of tone during the hot weather and an increase in its velvety lustre after the rains.

In the yearling buck the horns are without a spiral. In the second year a large open spiral is developed. It is believed that the full number of spiral twists are attained with the dark coat about the end of the third year. The best heads come from the dry and arid districts of the Punjab and Rajputana, the poorest from South India and the humid plains lying west of the United Provinces. Here a head above 18 in. is considered good. The record 31$\frac{7}{8}$ in. is from Jind State.

Black Buck are usually seen in herds of 20 or 30, though in Rajputana and the Punjab herds may number several hundreds. Black Buck live in open plains covered with scrub or cultivation. They feed on grass or various cereal crops. Usually Black Buck graze till mid-day and again in the late afternoon. Their sense of hearing is moderate: scent fair. Keen eye-sight and speed are their protection. When alarmed the herd moves off in a series of astonishing leaps and bounds and then breaks into a gallop. The leadership of the herd is usually vested in an old and vigilant female. There is generally an old buck in attendance who keeps in the vicinity. He frequently deserts the herd for a period taking a favoured doe with him. Black Buck breed at all seasons but mainly about February and March. Then the bucks grunt and strut about with their peculiar gait, their heads thrown well back. Their great face glands are everted and give off their strong smelling secretion. One or two fawns are born at a time, these are usually concealed by the mother in tall grass or among bushes.

Black Buck may be found practically all over the Indian plains except on the Malabar Coast. They avoid forest or hill tracts.

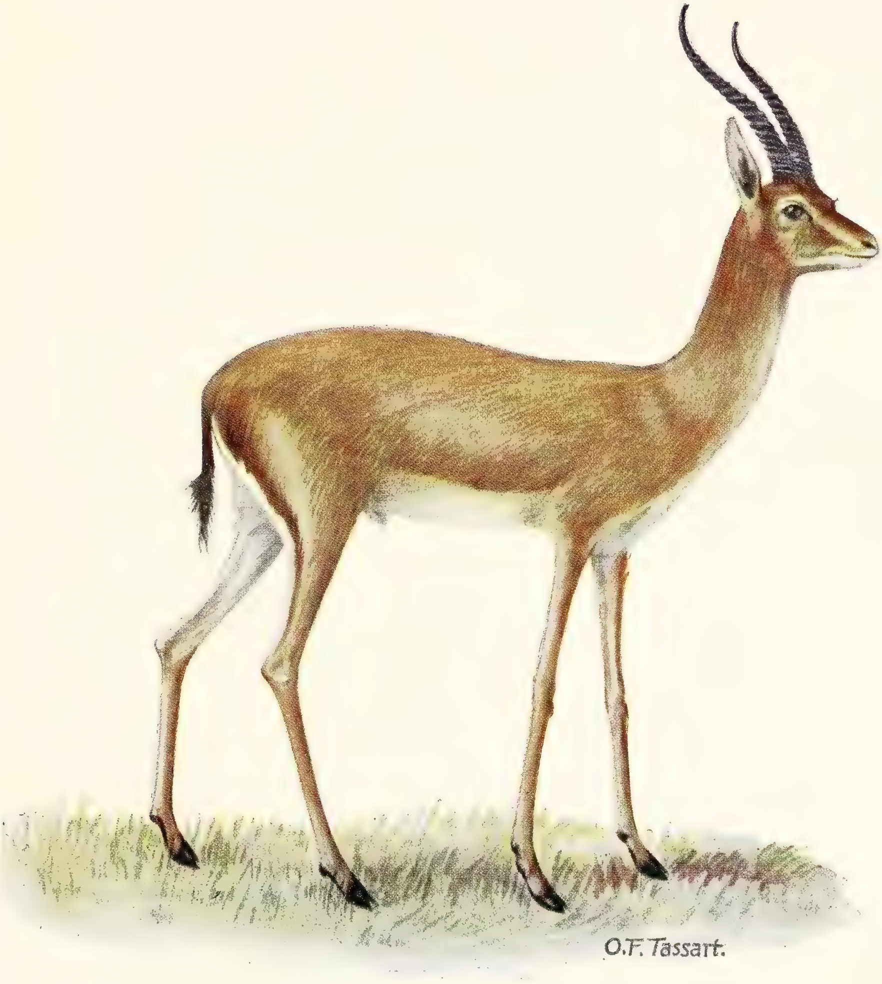
# THE CHINKARA OR INDIAN GAZELLE (*GAZELLA BENNETTI*, SYKES.).

Three species of Gazelles inhabit the Indian Region:—The Indian Gazelle (*Gazella bennetti* Sykes), The Tibetan or Goa Gazelle (*G. picticauda* Hodgs.) and The Seistan Gazelle (*G. seistanica* Lyd.).

The Chinkara or Indian Gazelle is found practically all over the plains districts of India. It lives in small herds of 10 or 20 in waste lands broken up by nullahs and ravines, in scattered bush and thin jungle. It is common in the sandhills of the desert zone. In the Salt Range, Punjab, Chinkara have been seen as high as 4,000 ft. They do not enter forest; prefer broken country and live less in open level plains than Black Buck.

A buck Chinkara is 26 in. high at the shoulder and scales about 50 lbs. The horns which usually have 15 or 16 rings average from 10-12 in. They rarely exceed this length in Central or South India. The best heads come from the dry desert tracts of Rajputana and the North-West. The record is slightly over 16 in. Both sexes are usually horned. Though hornless females are not uncommon. The horns of the doe are smooth conical spikes usually about 4-5 in. long, slightly curved at the tip or straight and distinctly ringed at the base. Chinkara are less diurnal than Black Buck. They lie up earlier in the day and come out later in the evening. A Chinkara is a wary animal when feeding, always on the alert, always raising its head to look round. When alarmed the herd goes off at a wild pace and then stops at about 200 or 300 yds. on some eminence to turn and discover the cause of their alarm. Their food consists of grass, leaves, various crops and fruits such as gourds and melons. They go without water for long periods but will drink when they can get access to it. There is no regular breeding season. One or two fawns are born at a time.

The Tibetan Gazelle inhabits North-Eastern Ladak, the Tibetan Plateau and Shensi. It is a small gazelle, from 24-25 in. at the withers. Its slender close ringed horns rise vertically and curve sharply backwards. A good head tapes 12 in. The record is 15½ in. The summer coat is short and slate grey. In winter it is dense and pale fawn. The Seistan Gazelle, described from Siestan in Persia, is found in Baluchistan. The females are hornless. The horns of the bucks bend backwards and have their tips more or less distinctly in-turned. The greyish forehead of the older buck and the white muzzle and a whitish band at the base of the horns are distinctive.



The Indian Gazelle or Chinkara (*Gazella bennetti* Sykes).
(*Height at shoulder 26 in.*).

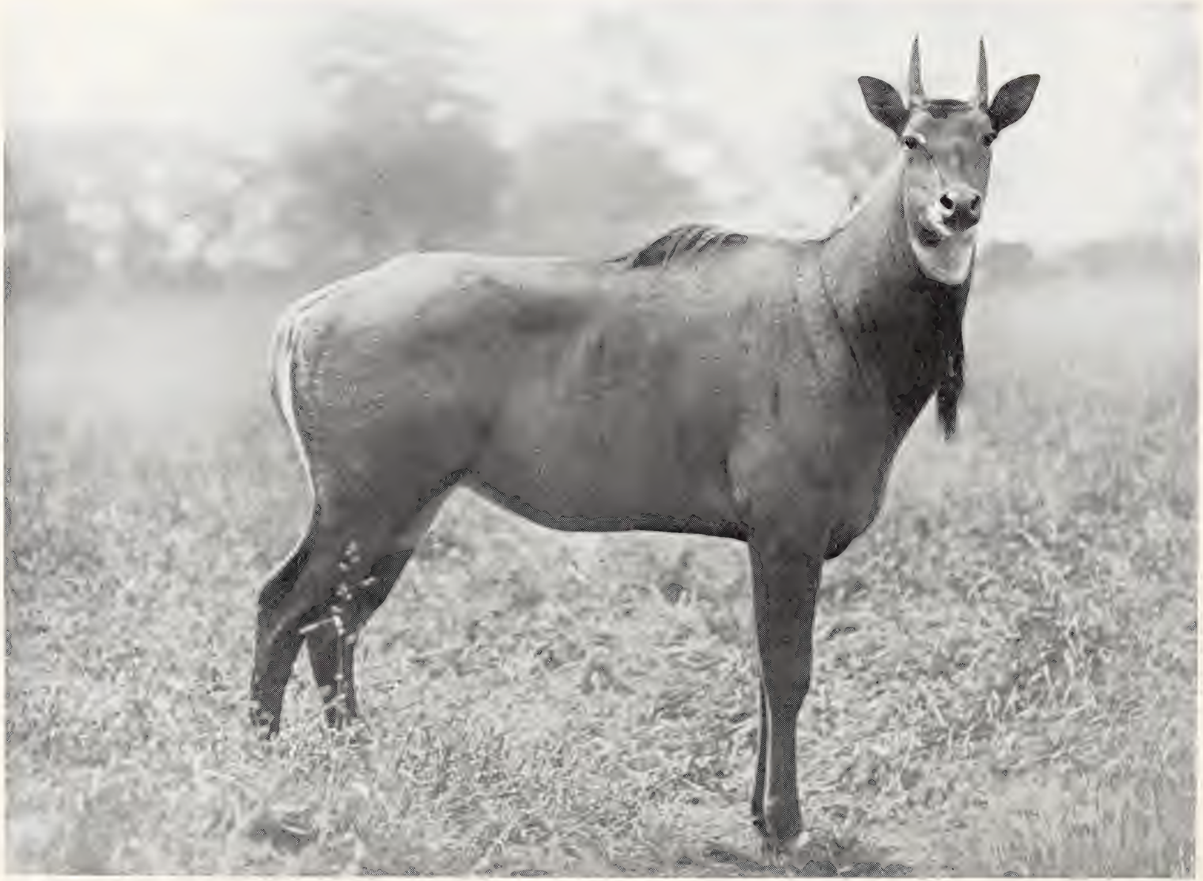


Photo by W. S. Berridge.

The Blue Bull or Nilgai (*Boselaphus tragocamelus* Pallas).

### Sub-Family V. *Tragelaphinae*: TRAGELAPHINE ANTELOPES.

The Tragelaphine Antelopes form a fifth division of the Hollow-horned Ruminants. The group is more African than Indian. It includes the African Bushbucks, Kudus, Bongo and Elands. Only two forms are found in India:—the Nilgai and the Four-horned Antelope. Tragelaphine Antelopes are characterised by the general absence of horns in the females (except in two African genera). The horns of the males are not ringed; they are keeled in front and in most genera, such as Eland, Kudu etc., they are spirally twisted. The Indian genera are characterised by the shortness and straightness of their horns, the absence of distinctive body stripes and by the possession of face glands. The hoofs are not deeply cleft as in true antelopes and there are no foot glands. The structure of the foot is practically the same as in Bovines—the molar teeth again are semi-Bovine. Lateral or false hoofs are well developed in both limbs. The muzzle is naked and the tail long.

The distributional area includes Ethiopian Africa and Peninsular India. There is reason to believe that a Tragelaphine Antelope probably existed in the Euphrates Valley during the Assyrian period.

# THE FOUR-HORNED ANTELOPE (*TETRACEROS QUADRICORNIS* BLAINV.).

The Four-horned Antelope or *Chousingha* is the only Antelope with 2 pairs of horns. Of these the front pair are always the shorter. At times they are no more than horn-covered studs or mere bony knobs under the skin. The maximum length of the back pair is 4½ in., of the front 2½ in.

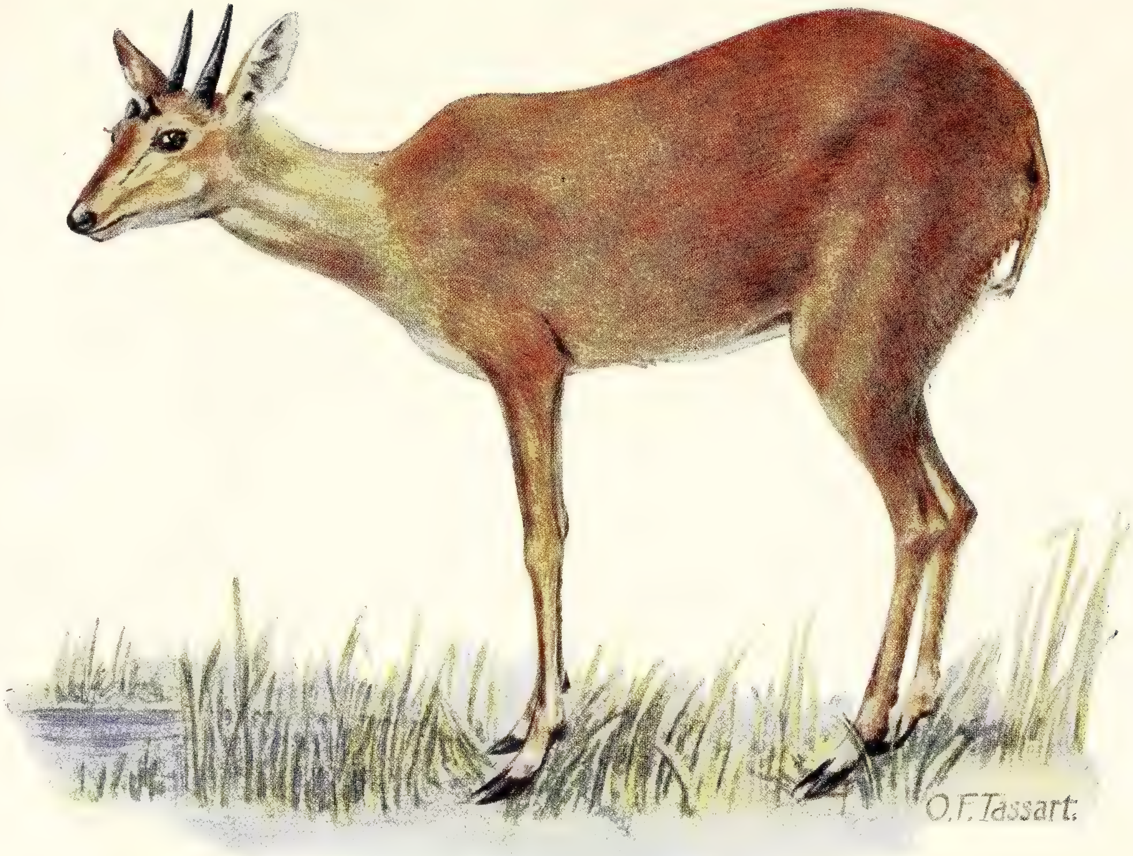
One of the most interesting features in this Antelope is the presence of a pair of well-developed glands between the false hoofs of the hind legs in both males and females. This is the only antelope which has such glands.

The *Chousingha* is about 25 in. high and scales near 50 lbs.

Its coarse coat is dull red brown above and white below. It lives in undulating or hill country and shelters in tall grass or open jungle—a terrain more usual to deer than to antelope. In this environment it has developed some of the habits of deer. It has a low whistling call, which the bucks repeat frequently in the hot weather and a sharp alarm note which the doe uses to guide her fawns through cover when in flight.

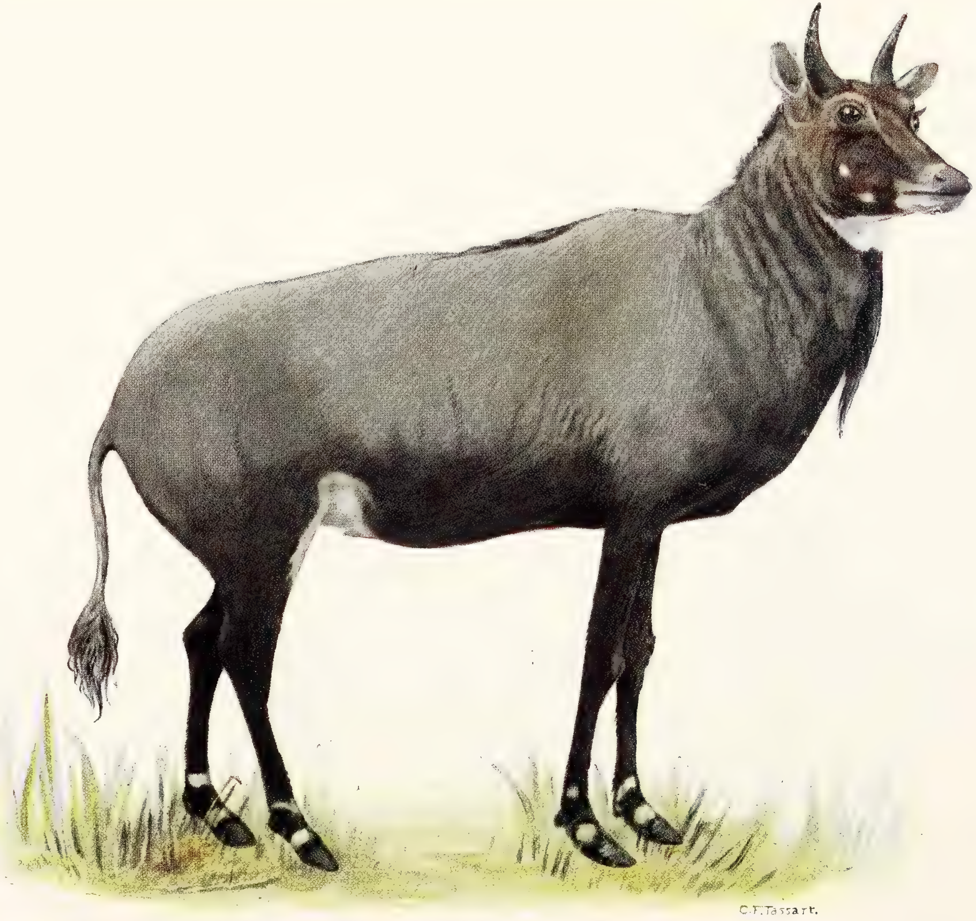
These little antelopes drink regularly. They are much more dependent on water than other antelopes and seldom live far from it. The edge of the jungle round a village tank is a favourite resort. Again, unlike antelopes they do not gather in large herds. *Chousingha* are usually seen alone or in pairs. In the early part of the year, before the rains, the female may be accompanied by one or two fawns. Sometimes two old animals and two young will be seen together, or even a buck with 4 or 5 does.

The Four-horned Antelope is found along the base of the Himalayas. It does not occur in the Gangetic plain. In the peninsula of India it has a more or less localised distribution. Here it keeps to the hill tracts covered with open forest. It is not found on the Malabar Coast.



The Four-horned Antelope (*Tetraceros quadricornis*, Blainv.).

(*Height at shoulder about 25 in.*).



The Nilgai or Blue Bull (*Boselaphus tragocamelus*, Pallas).
(*Height at shoulder 56 in.*).

## THE NILGAI OR BLUE BULL (*BOSELAPHUS TRAGOCAMELUS* PALL.).

The Nilgai is a great ungainly antelope standing fully 54 in. at the shoulder and weighing about 600 lbs.

Its high withers and low hind quarters recall the build of the African Hartebeeste. As is usual with so many African Tragelaphines, the sexes differ in colour.

The adult bull has a coarse iron grey coat. He has a white ring below each fetlock and two white spots on each cheek. His lips, chin, the inside of his ears and the undersurface of his tail are white. Young bulls and the cows are tawny. Both sexes have dark manes and the males wear a distinctive tuft of stiff black hairs on the throat. The bulls have stout cone-like horns. They are distinctly keeled, triangular at the base and circular towards the tips.

Horns average about 8 in. The maximum length is 11¾ in.

Nilgai are usually seen in herds of 10-15 animals. Males are often solitary or perhaps several bulls will herd together. Females and young, attended or not, by one or two old males may be seen in smaller or larger parties. The country they live in may be level, undulating or hilly. They favour a mixture of grassland, scrub and cultivation, usually avoid really dense forest but will live in more or less open tree jungle.

They feed on grass and cereal crops and browse on leaves and wild fruit and are particularly fond of eating the fallen flowers of the Mowha tree. They feed at all times of the day.

When alarmed the herd goes off with an ungainly slouching gallop covering the most difficult ground with ease.

Nilgai droppings are commonly found heaped in one particular spot. This habit is common in many animals. It is suggested that the spot may provide *rendezvous* for reassembling the scattered members of a herd.

The period of gestation is 8-9 months. Young are seen at all seasons.

The Nilgai is found in the Indian Peninsula from the base of the Himalayas to Mysore. It does not occur in Eastern Bengal or Assam or on the Malabar coast. The sanctity attributed to it is the main source of its protection in many districts where it has survived.

## Family II. *CERVIDAE* OR DEER.

The last tribe of true ruminants is the Deer. Branching horns or antlers are the distinctive appanage of deer. Save in one or two aberrant forms only males carry them. In the Reindeer alone both sexes are horned. Deer, like other ruminants, are generally large and heavy creatures without the agility and litheness of beasts of prey. It is precisely to this sort of animal, where weight is an important factor, that horns are the most suitable weapons. They are perhaps a counterpoise to the teeth and claws of Carnivores. The need for defence against enemies, for weapons of attack in combats with their own kind has led to this distinctive form of protective armament among hoofed animals. But there is a distinction between the horns of oxen, sheep and antelopes and the deer tribe. A deer's horn when fully developed is really a mass of dead bone, devoid of any covering of skin or horn. The antlers are worn for a time, shed and then replaced. The budding antler grows from a pedestal or pedicel of bone which forms part of the skull. It appears as a velvety knob, grows rapidly, increasing in length by the vigorous deposition of bony matter. In young deer it remains a simple spike. In adult stags it branches into tines and takes the form of the complete antler. The new grown antler is highly sensitive. It is covered with 'velvet'—a thick soft skin, fed by numerous blood vessels and clothed with a mat of fine hair. When the growth of the antler is complete, a ring of bony matter, the 'burr', forms at its base just above its union with the pedicle. The bony ring constricts and cuts off the flow of blood to the antler. The blood vessels in the 'velvet' dry up. The 'velvet' shrinks and is eventually rubbed away by the deer. When present, it takes the place of the horny sheath which forms a permanent cover over the bony cores of the horns of cattle and other hollow-horned ruminants. But in the deer the outer cover of the antler is temporary. It is removed and leaves behind the dead bone which we call horn.

Besides the antlers, there are other characters which distinguish deer from other ruminants. Deer have a large fissure in the skull just in advance of the eye socket. As a rule canine teeth are present in the upper jaw. They are particularly well developed in forms which have no antlers such as Musk deer and Chevrotains.

Again, with the exception of the Musk deer, none of the tribe have a gall bladder. All deer have well developed lateral hoofs in both feet. The tribe ranges over a great part of Asia, North and South America and North-West Africa.

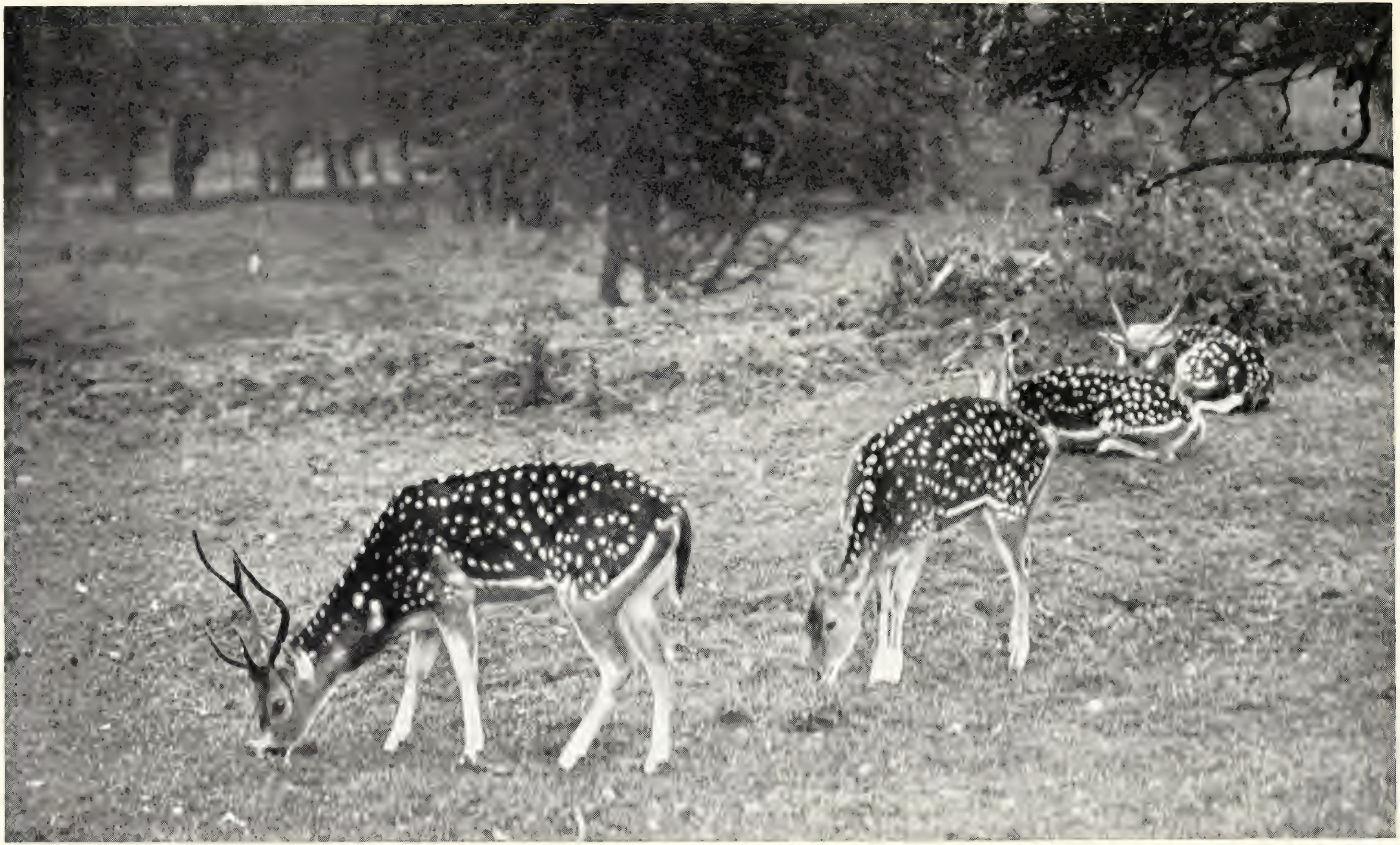
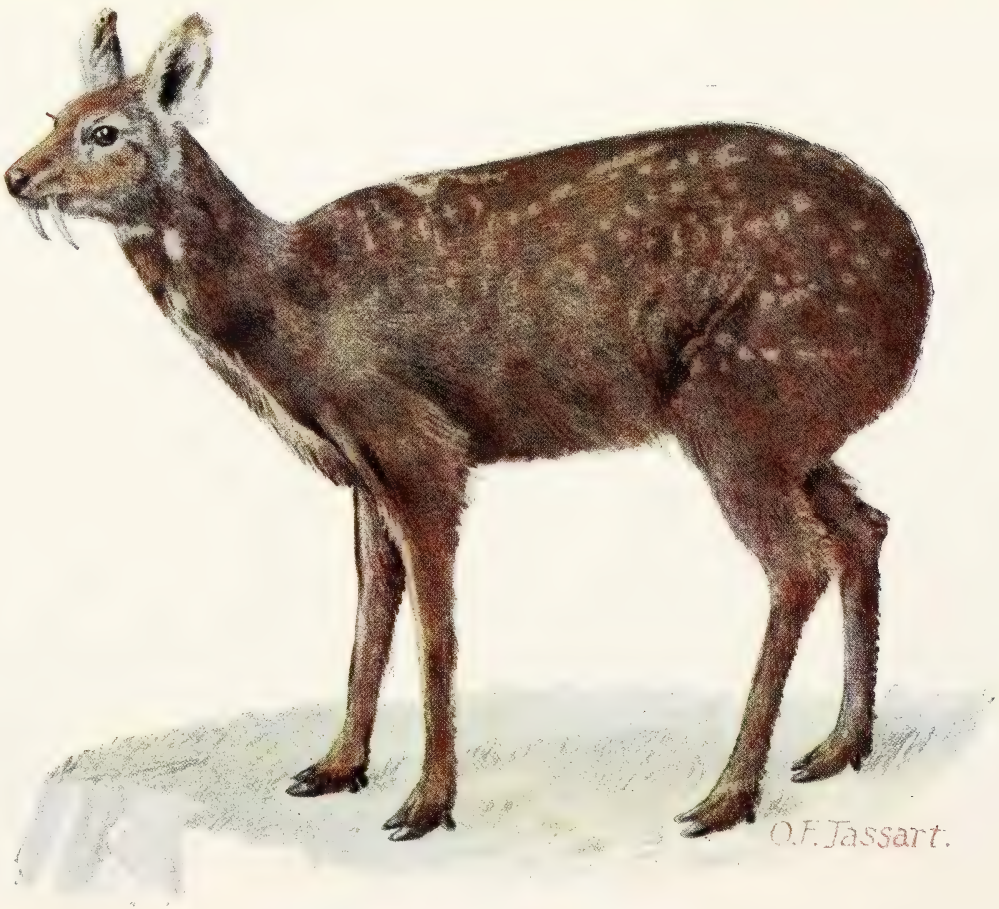


Photo by W. S. Berridge.

Axis, Spotted Deer, or Chital (*Axis axis* Erxl.).



The Musk-Deer (*Moschus moschiferus* L.).

( *Height at shoulder 20 in.*).

### Sub-Family I. *Moschinae*: Musk Deer.

## THE MUSK DEER (*MOSCHUS MOSCHIFEROUS* L.).

The Deer tribe is divided into two groups or sub-families—the *Moschinae,* containing a single genus and species the Musk deer and the *Cervinae* which includes all the remaining deer. The Musk Deer holds a place between the deer and the antelopes. It is regarded as an undeveloped form of deer which has not progressed with the rest of its tribe. It is hornless, has no face glands; these are generally present in all deer, and it has a gall bladder which no deer possesses. In some ways it has taken a special line of development of its own. This is seen in its possession of a caudal gland and a musk gland. The tail of a musk deer is peculiar. It is completely buried in the long hairs of the anal region and is for the most part naked except for a large tuft at the tip and a tuft at the base which covers its upper surface and sides. The lateral surface of the tail bears a narrow slit in its flacid skin which is the opening of the caudal gland. The musk gland is situated beneath the skin of the abdomen of the males. When fresh its secretion has an unpleasant pungent, urinary odour, when dry it acquires the scent of musk. Valued as a commercial product it induces the persecution of the species. From the great development of the caudal and musk glands it is inferred that in this deer the females seek out the males in the breeding season. Finally, musk deer have specially mobile feet, the hoofs are long and pointed and the unusually large lateral hoofs are well adapted to give it a foothold on snowy slopes and slippery rocks. The absence of horns is compensated by the great development of the canine teeth.

The Musk Deer is a little creature standing 20 in. at the shoulder and weighing as many lbs. It is protected from the cold by a deep coat of thick and bristly hairs, almost pithy in structure. The general colour is a shade of rich dark brown speckled with grey. It lives singly or in pairs. Musk deer are generally met with in birch forest above the zone of the pines, at times they come down to lower levels but always keep in thick cover. They scrape out a shallow form in which they lie concealed and come out to feed in the mornings and evenings.

The breeding season is believed to be in January and the young are born in June. Musk Deer range over a wide area in Central and North Eastern Asia. The typical form *Moschus moschiferous* is found in Kashmir, Nepal and Sikhim.

## Sub-Family II. *Cervinae*: Deer.

### THE MUNTJAC (*MUNTIACUS MUNTJAK* ZIMM.).

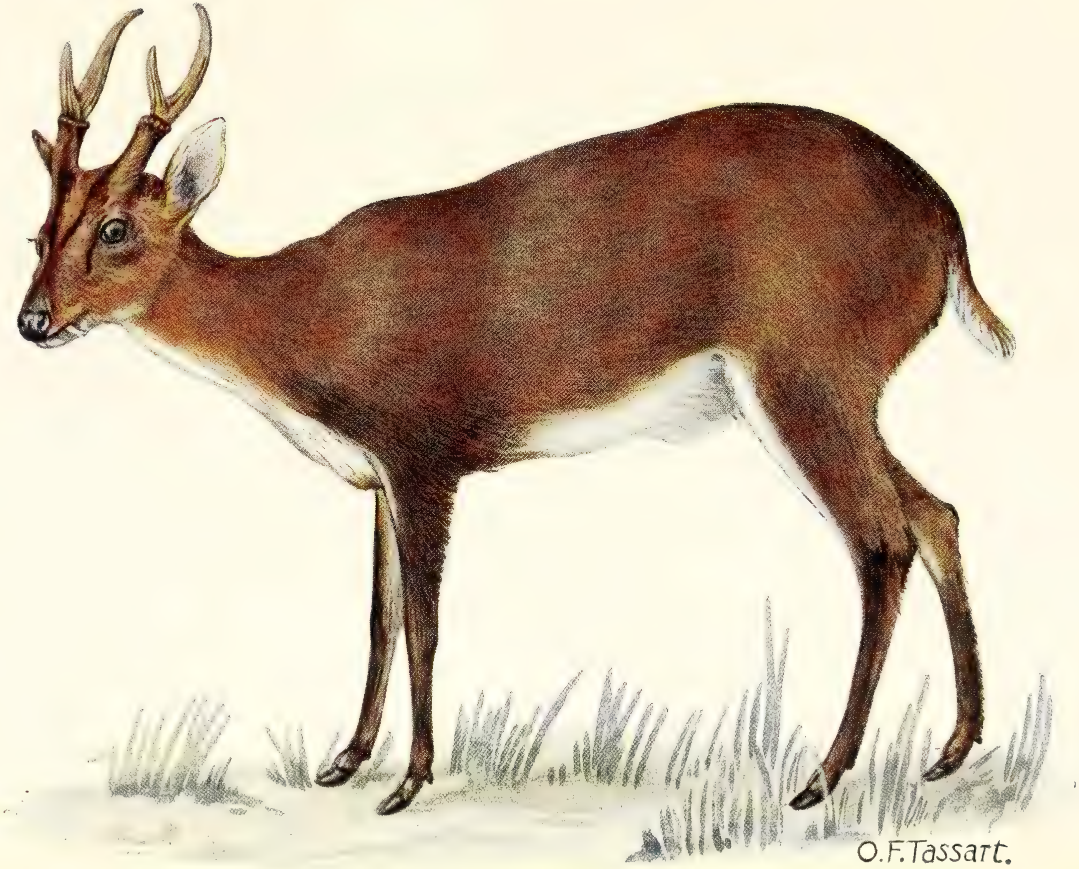
The second division of the Deer tribe—the *Cervinae* contains all the remaining deer. True deer have no gall bladder, no caudal or musk glands—all present in musk deer. With the exception of Roe deer, all deer have face glands. Again, all, save the Chinese water deer, have antlers and all of them, except the little Pudu deer of the Chilian Andes, have foot glands. The group contains 19 genera six of which are present in our area.

The Muntjacs, known also as Barking Deer, are small animals standing from 20-30 in. at the shoulder. The antlers are small. They consist of a short brow tine and a beam which is undivided and curves downwards and inwards at its extremity. The horns are set on long bony pedicels. A bony ridge extends down each side of the face from the base of each pedicel. The marked prominence of the facial ridges gives the creature the name 'rib-faced deer'. In females there is a bristly tuft of hair and a small projection in place of each horn.

Muntjacs range over the greater part of the Indo Malayan countries and are found also in China, Formosa and Japan. Various races are recognised over this wide range.

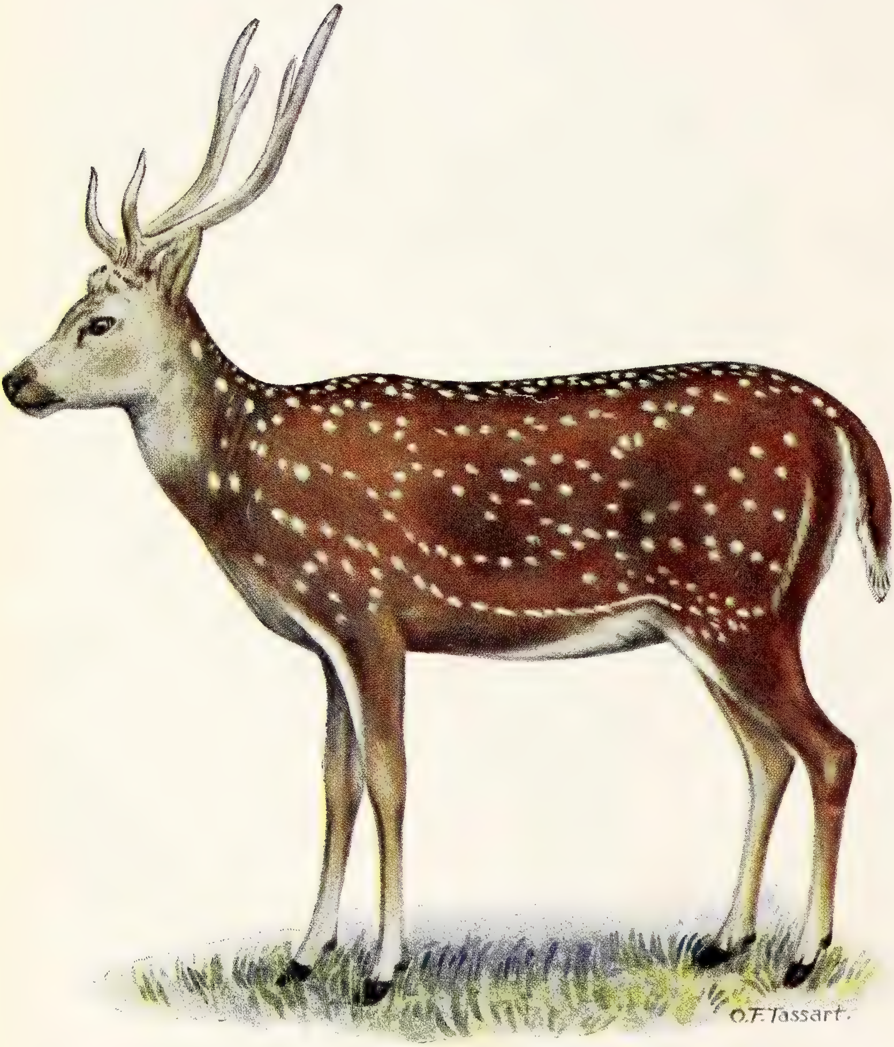
In our area there are supposed to be three: the Muntjac of North India is known as (*Muntiacus m. vaginalis*); the southern form is (*M. m. aureus*). The third race (*M. m. grandicornis*) is found in Burma. The Muntjac of Tenasserim (*M. feae*) is regarded as a distinct species. The coat of the Burmese Muntjac is described as tawny yellow; the North Indian race is bright chestnut. A bright red form is equally common in Burma. The antlers of an adult male in Burma average 4 in., their bony pedicels measuring from 2-4 in. The best Burmese head is 7 in. Average Indian antlers measure from 2-3 in. The pedicel 3-4 in. The maximum length obtained in the C.P. is 7 in. A good buck weighs from 48-50 lbs. Horns are shed during May and June. The Muntjac is a solitary animal. It is seen singly or in pairs; more rarely, in small family parties. It keeps to more or less thick jungle and comes out to graze in the outskirts of forest or in open clearings. It is fairly diurnal in habit. The food consists of various leaves and grasses and wild fruits. Its call from a distance sounds much like the bark of a dog. It is given out at intervals; usually in the mornings and evenings, sometimes after nightfall.

When alarmed and in flight these deer give out a series of short cackling barks which may be reduced to a sharp rattle likened to the sound of castanets. Muntjac appear to breed at all seasons. The rut mainly takes place in the cold weather. The young usually one—sometimes two, are born at the beginning of the rains. The young are spotted white till about 6 months old.



The Muntjac or Barking Deer (*Muntiacus muntjak* Zimm.).

(*Height at shoulder 20-30 in.*).



The Chital or Spotted Deer (*Axis axis* Erxl.).
(*Height at shoulder 36 in.*).

## THE CHITAL OR SPOTTED DEER (*AXIS AXIS* EXRL.).

The Chital, perhaps the most beautiful of all deer, is found only in India and Ceylon. In India, it is found in the forests at the base of the Himalayas and practically throughout the peninsula wherever there is more or less open jungle combined with good grazing and a plentiful supply of water. It is unknown in the arid plains of the Punjab, Sind, in a large portion of Rajputana, in Assam and the countries east of the Bay of Bengal.

The Spotted Deer is at its best in the Himalayan foot hills, in the jungles of the Terai and in the Central Provinces. A well-built stag from these parts stands 36 in. at the shoulder and weighs about 190 lbs.

In South India, or in the jungles of the Sunderbans, the height seldom exceeds 2 ft. 6 in. The coat is a bright rufous fawn profusely spotted with white. The lower series of spots on the flanks are arranged in longitudinal rows and suggest broken linear marking. Its dappled hide almost obliterates the chital in a sun-flecked jungle, particularly when it sits down to rest as it usually does, in some shady place.

The graceful antlers have 3 tines—a long brow tine set nearly at right angles to the beam and two branch tines at the top. The outer tine, the continuation of the beam, is always the longer.

The record head measures 39¾ in. A 34 in. antler would be good anywhere; 31 in. in South India.

One always associates Chital with beautiful scenery, with grassy forest glades and shaded streams. They are seen in herds of ten to thirty, which may contain two or three stags; but assemblages numbering several hundred have been met with. They do not shun the proximity of villages, enter cultivation and frequently associate with many forest animals, particularly with monkeys. They are less nocturnal than sambar and feed till late in the morning and again in the afternoon, and lie down in the interval in some shaded spot.

The time at which the stags shed their antlers varies in different localities. In the Central Provinces and South India, as a rule, stags cast their horns in August and September. The new antlers are in velvet till the end of December. But stags carrying horns in various stages of development have been seen at all seasons. It is suggested that regularity in the intervals at which antlers are shed is only attained by fully mature stags. In the Central Provinces, the pairing season is at its height in May. The rutting stag has a loud harsh bellow and combats between males for the possession of the hinds are fierce and frequent. In North India the pairing is said to take place during the winter months. Fawns may be met with at any season. One to three are born at a time—two being the commoner number. Chital are prolific breeders; an interval of 6 months may see the production of a new family.

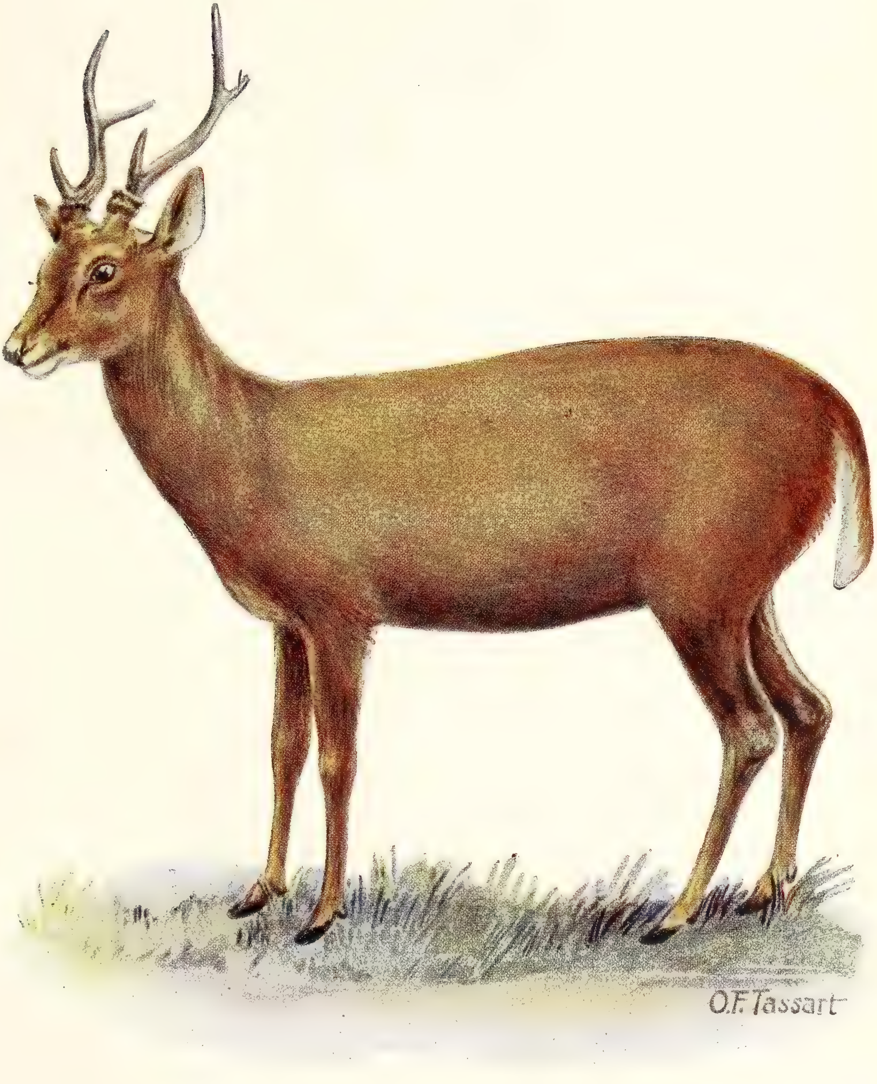
## THE HOG DEER (*HYELAPHUS PORCINUS* ZIMM.).

The name Hog Deer has been probably suggested by the squat pig-like appearance of this animal and by its hog-like movements. When running it keeps its head low down, moves without that bounding action so characteristic in deer.

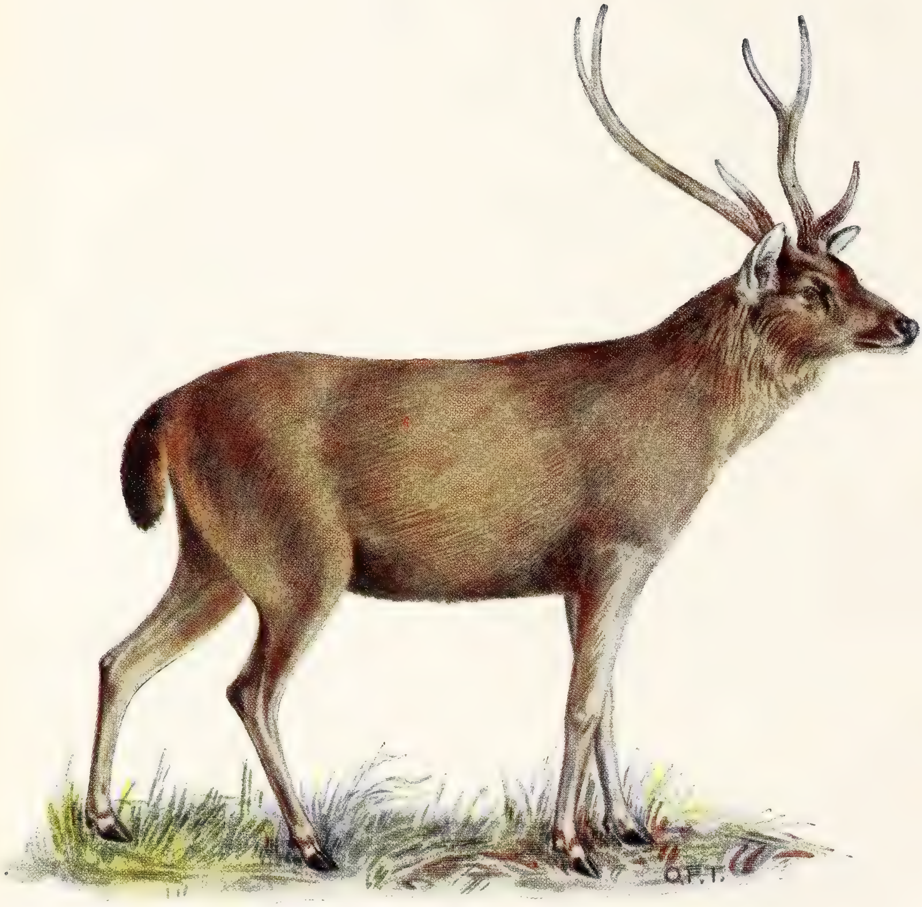
The Hog Deer is a relative of the Chital but is smaller and stouter in build. The body is long and the legs relatively short. The height at the withers is about 27-29 in. The fur is brown, dark brown in old stags, with a yellowish or reddish tinge. The white tips to the individual hairs give the coat a speckly appearance. The under parts of the body are paler and the inside of the ears and the underside of the tail are white. The young are spotted. Some young stags and hinds show these spots though they are not always discernible. The summer coat is generally paler.

The small antlers are set upon very long bony pedicels. After giving out a short brow tine the beam is almost straight till it divides into a shorter fore and longer hind tine. Average horns measure from 12-15 in. Burmese stags carry better heads than Indian. The record is 24 in. Hog deer favour grass jungles by the banks or rivers, grass-covered delta islands or open grass plains; always where the grass is not too high. On the banks of the Indus in Upper Sind they live in scrub jungle and in Burma, they were once common in mangroves. Hog Deer are generally solitary creatures. A pair will continue to frequent a particular stretch of grassland. Sometimes small parties of 2-5 may be found grazing together. They come out to feed early in the mornings and in the evenings, and shelter in long grass during the hot hours of the day. They are wary creaures; their sense of sight, smell and hearing is acute. Persecution has made them almost nocturnal in many parts of their range.

The main pairing season is believed to be in September and October and the young are dropped in April and May. Pairing must also take place earlier in the year as young are often born during the rains. The period of gestation is 8 months. The Hog Deer is not found in the Indian Peninsula. It lives in the low alluvial grass plains of North India from Sind and the Punjab to Assam whence its range extends into Burma and Tenasserim.



The Hog-Deer (*Hyelaphus porcinus* Zimm.).
(*Height at shoulder 27-29 in.*).



The Sāmbar (*Rusa unicolor* Kerr.).

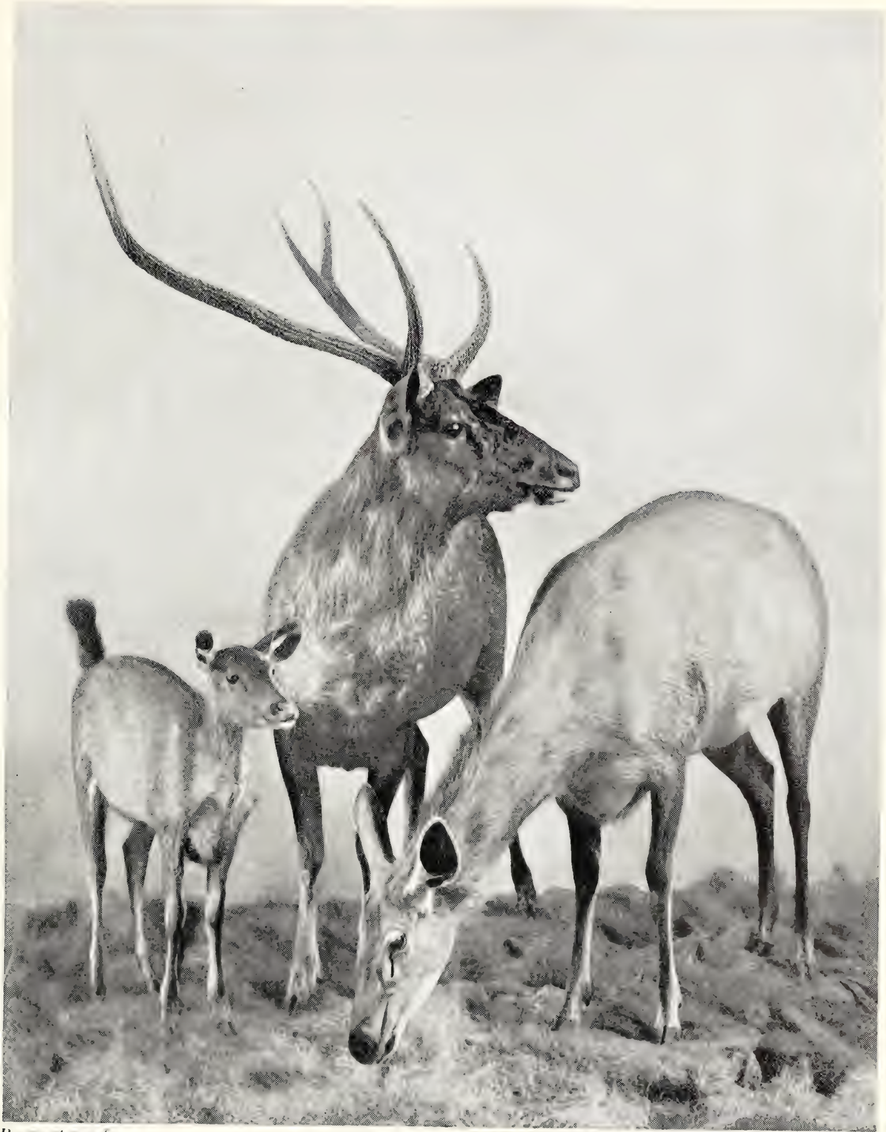
(*Height at shoulder 5 ft.*).

## THE SAMBAR (*RUSA UNICOLOR* KERR.).

The Sambar is the typical forest deer of South Eastern Asia. In the Indian Empire it is represented by the Indian Sambar (*Rusa unicolor*), whose range includes Ceylon and by the Malay Sambar (*Rusa unicolor equinus*), which inhabits Assam, Burma and the Malay countries.

Of the many races of Sambar, the Indian is the largest and carries the grandest horns. It is a heavily built deer which may reach a shoulder height of nearly 5 ft. The average height is about 55 in. A full grown stag scales from 500-600 lbs. The coat is coarse and shaggy. In stags it forms a mane about the neck and throat. In the hot weather much of the hair is shed. The general colour is brown with a yellowish or greyish tinge. The under parts are paler. Females are lighter in tone. Old stags tend to grow very dark—almost black. The antlers are stout and rugged. The brow tine is set at an acute angle with the beam. At its summit, the beam forks into two nearly equal tines. In some heads the outer, in others the inner tine is longer. The full number of points are developed in the fourth year. The Sambar stag is said to be at its prime in its ninth year. Really old beasts carry poor heads. Sambar from the Himalayan foot hills have more rugose and perhaps more massive antlers than those of the C.P., but they are never so long or so graceful. The finest heads come from the forests about the Narbada and Tapti and from the Central Provinces generally. The record is the famous head from Bhopal which tapes $50\frac{7}{8}$ in. The horns of the Malay Sambar are set closer. They have a more rugged and massive appearance. The average length is 26 in. A head over 30 in. is good.

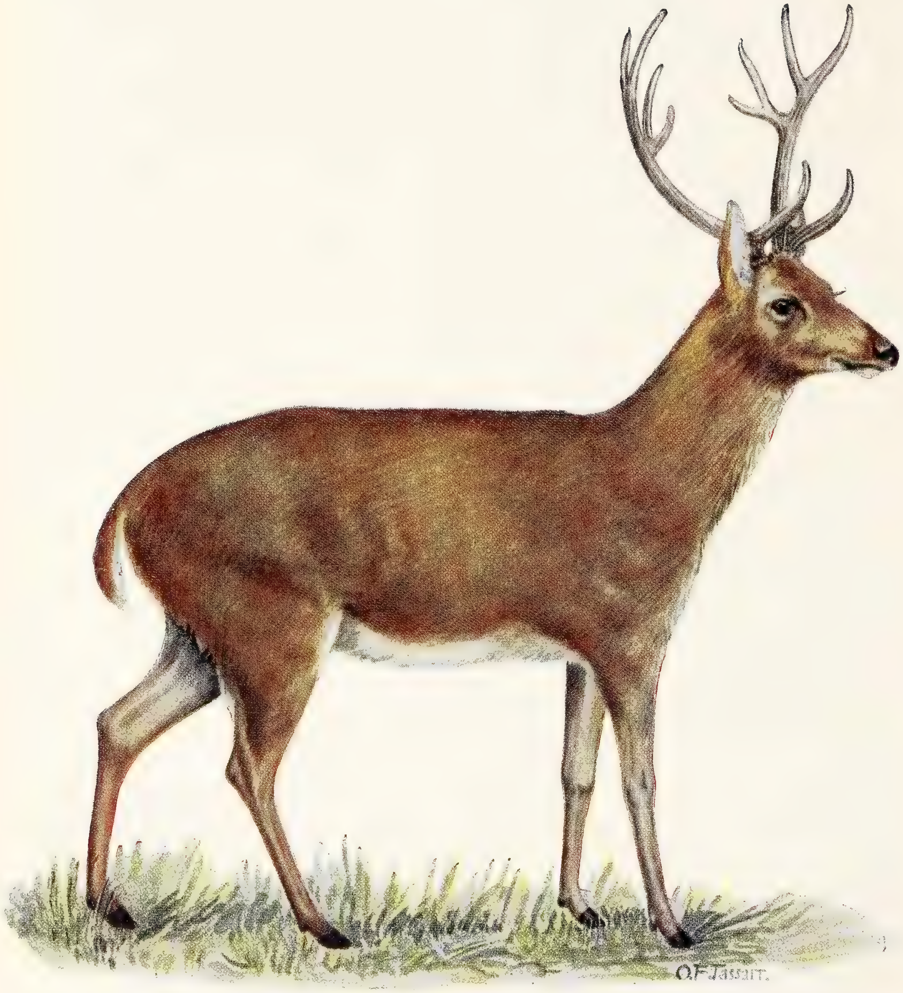
Forested hill sides, preferably near cultivation, are the favourite haunt of Sambar. Their food consists of grass, leaves and various kinds of wild fruit. They feed mainly at night and retire into heavy cover at day-break and do not come out till dusk. The capacity of so heavy an animal to move silently through dense jungle is amazing. Their powers of sight are moderate; their scent and hearing acute. Sambar take to water readily and swim with the body submerged only the face and the antler showing above the surface. There is much variation both as to the pairing season and the time at which the antlers are shed. Stags in velvet and others with mature horns are seen together. In Central and Southern India the majority of stags cast their antlers between the end of March and mid-April. The horns commence to grow in May and are in velvet during the rains. In September, the stags commence to clean their horns by rubbing them against trees. The tree is taken between the brow tine and beam and the antler is rubbed up and down leaving a long blaze on the bark. Most of the stags are clear of velvet by November. They roar in challenge to each other. The challenge is a loud metallic bellow quite distinct from sharp short 'ponk' which is the alarm note. The males fight for territory. Each stag fights to obtain sole rights over some favoured valley. The victor becomes master of the hinds which enter it. The hinds are attracted to the stags by their calls and the scent of the face glands, which are everted during the rut and give out their strong smelling secretion. Pairing takes place in November and December. The stag's harem is limited to a few hinds. After the rut he deserts them and lives a solitary life till the return of the mating season. The young are born at the commencement of the rains, in late May or early June. Young stags remain with the hinds. Sambar are rarely found associating in large numbers. Four or five to dozen are what one usually sees. Both stags and hinds are seen singly or a party of hinds and fawns without a stag.



By courtesy of Amer. Mus. Nat. Hist., New York.

The Sambar or Rusa Deer (*Rusa unicolor* Kerr.)

(*Height at shoulder 5 ft.*).



The Swamp Deer (*Rucervus duvaucelli* Cuv.).

(*Height at shoulder 54 in.*).

## THE SWAMP DEER (*RUCERVUS DUVAUCELLI* CUV.).

The Swamp Deer group, forming the genus *Rucervus* contains three species within our area:—The Swamp Deer (*Rucervus duvaucelli*), Eld's Deer (*Rucervus eldi*) of Manipur and the Thamin (*Rucervus thamin*) of Burma.

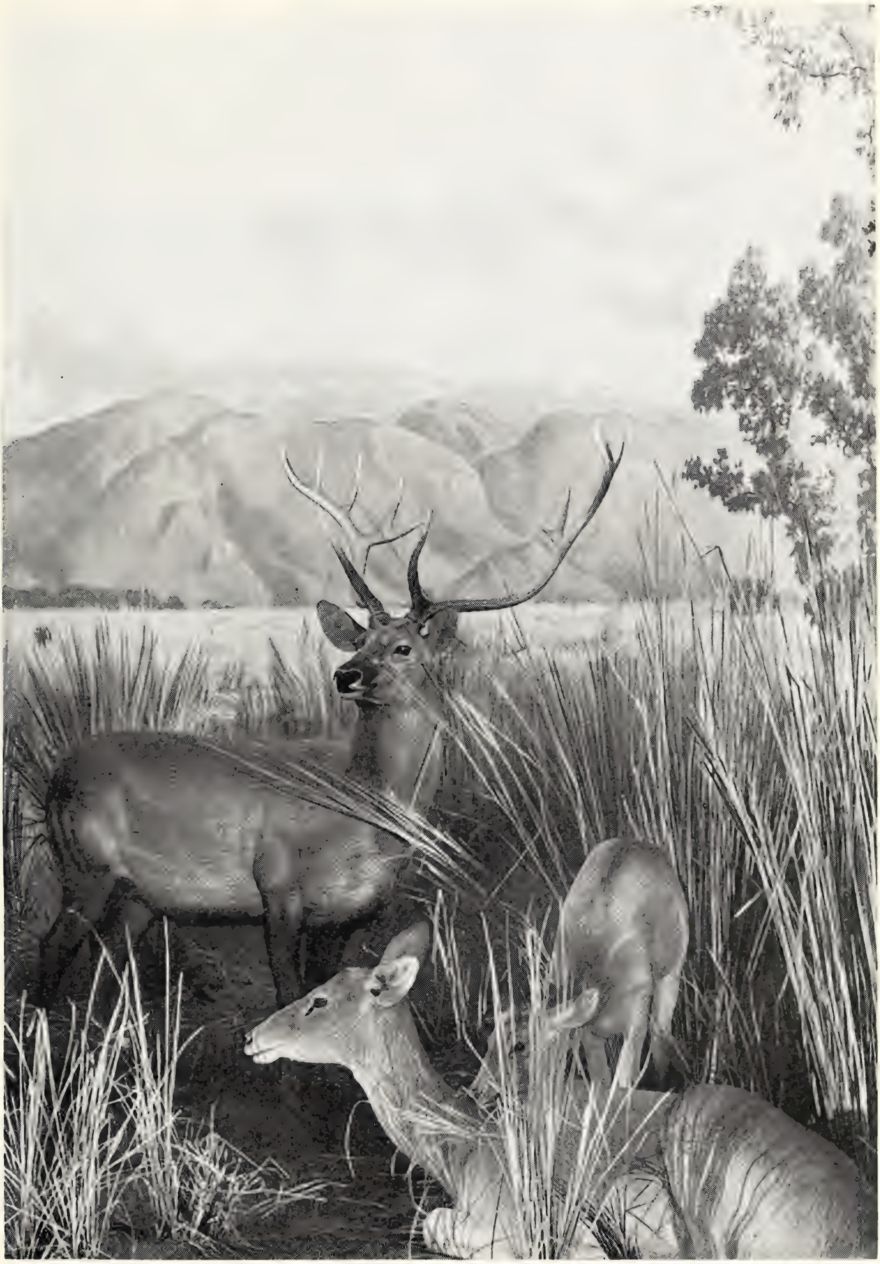
The Swamp Deer—the *Barasingh* of the Central Provinces and the *Gond* of the United Provinces and Terai is found in the Central Provinces, the United Provinces, parts of Assam and the Sunderbans. Its occurrence in Sind is doubted.

This splendid deer attains its finest development in the Central Provinces. A good stag stands 54 in. at the shoulder and scales from 370-400 lbs. Its coat almost woolly in texture shades from brown to yellowish brown. The stags are maned and darker in colour. The summer coat of stags and hinds is paler, some develop spots, not always distinct, of lighter tone. The young are spotted.

There is much variation in the form of the antlers. Two distinct types are recognised with a wide range of intermediary patterns. In the first form, the beam takes a backward and then forward curve bringing the points of the horns in line with the top of the head. Half way up the beam, tines are given off at intervals: the first usually having a shoot of its own. In the second and far handsomer type, the brow tine is set at right angles to the beam, which grows with an outward curve giving the antlers a wider spread. At the point where it branches, the beam takes an almost horizontal curve and gives off number of vigorous vertical tines each of which throws out shoots. The whole effect is to produce an extraordinarily beautiful form of antler. Antlers from the Terai are smoother and whiter than C. P. heads. Heads exceeding 41 in. are rare. 10-14 is the usual number of points, though antlers with as many as twenty points have been obtained. The term Swamp Deer exactly suits the animal in the Terai where it lives in marsh land and is seldom out of water. In the Central Provinces this deer lives in grassy plains on hard ground and is, on the whole, less dependent on the proximity of water than the Chital. In Assam they usually live in high ground in the proximity of water. Swamp Deer are highly gregarious. In parts of the Terai a few miles of swamp may contain thousands of these magnificent animals. Swamp deer are less nocturnal than Sambar. They feed till late in the morning, again in the evening and lie up during the day. Their eyesight and hearing is moderate. The sense of smell acute. When alarmed the whole herd sets up a shrill baying sound which is continued in flight. In Assam the antlers are shed in February and March. The new antlers appear between April and May. They are in velvet till the end of July and are clean by the end of September. In the U.P. and C.P. stags are hornless by mid-April. Horns are mostly in velvet between May and August. They harden in September and are generally clear of velvet by mid-October. The master stags assemble.

Their eerie and penetrating roars are thrilling and impressive. They live more or less in amity till the rut develops. In the C.P. this is mainly between mid-December and mid-January. In the U.P. the chief rutting season is in November and December. The males fight for the possession of the hinds and each master stag so acquires his harem which may number as many as 30 hinds. It is reported that in Assam the pairing season is in April and May when the stags' new antlers are beginning to sprout!

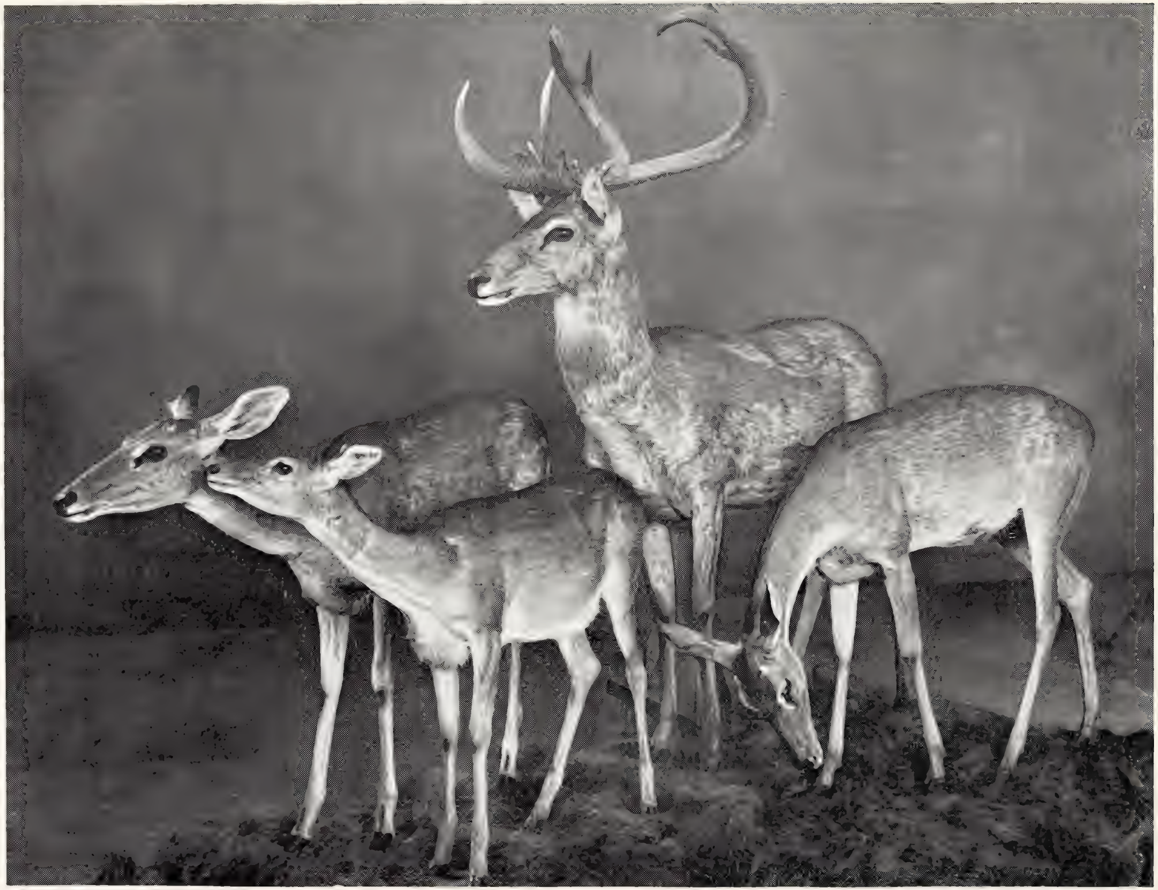
With the cooling of their short-lived ardour the stags desert the hinds. The master stags collect again in small herds. The younger males remain with the hinds. The finest stags go off to live alone or in company with another of equal development. The young are born just before the rains. In Assam the young are born mainly between December and January or as late as February.



*By courtesy of* *The Amer. Mus. Nat. Hist., New York.*

Swamp Deer (*Rucervus duvaucelli* Cuv.).

(*Height at shoulder 54 in.*).



By courtesy of The Amer. Mus. Nat. Hist., New York.

The Brow-antlered Deer or Thamin (*Rucervus eldi* McClell.).

(*Height at shoulder nearly 4 ft.*).

## THE THAMIN OR BROW-ANTLERED DEER (*RUCERVUS THAMIN* THOS.).

The Thamin, the typical deer of Burma, is found mainly in the dry zone of Central Burma. It is sparingly distributed in other parts of the Province. It was once found in immense numbers in the wide plains of Pegu.

This beautiful deer is nearly 4 ft. high at the withers. The hinds are smaller. The coat is coarse and sparse. In stags it is dark brown or nearly black. Stags have a dense mane or ruff about the throat. Hinds are a light fawn. The young are spotted. There appears to be a seasonal colour change; the dark brown thamin of the cold season developing into the yellowish brown animals of the hot weather. The close set antlers are very handsome. In profile their form is almost circular. From the tip of the brow tine to the point of the beam the antler sweeps in one continuous, graceful curve. The number of terminal tines varies from two or three to as many as eight or ten. There are supposed to be two races of Thamin in Burma. The typical thamin and Bruce's Thamin (*R. thamin brucei*), described from the Ruby Mines District, in which the horns are said to be slightly palmated. The maximum length of the antlers is 42 in. Heads over 35 in. are good. Stags are believed to acquire their horns in the second year and reach their prime when 7 years old.

Thamin avoid hills or heavy forest. These Deer prefer open scrub jungle on flat or undulating land between rivers and hill ranges. They live in small herds, lying up in cover during the heat of the day and feeding in the mornings and evenings. After nightfall, they come out to graze in the large *lwins* and *kwins* or to raid crops in their vicinity. Their speed and sharp sight is their main protection.

Stags shed their antlers in mid August and are clear of velvet by the end of December, when the horns are at their best. The rut develops between March and April. The period of gestation is 8 months. The fawns, one at birth, are dropped mostly in October. After the rut the master stags go off either alone or attended by one or two hinds. Big stags are seldom seen with the herds after May.

Eld's Deer (*Rucervus eldi*) is confined to Manipur where it lives in grassy swamps. Its antlers are indistinguishable from the Thamin. The hind pasterns are horny instead of hairy and applied to the ground when walking.

Thamin have suffered much from persecution in Burma. Without effective measures for their protection this beautiful deer must face extinction.

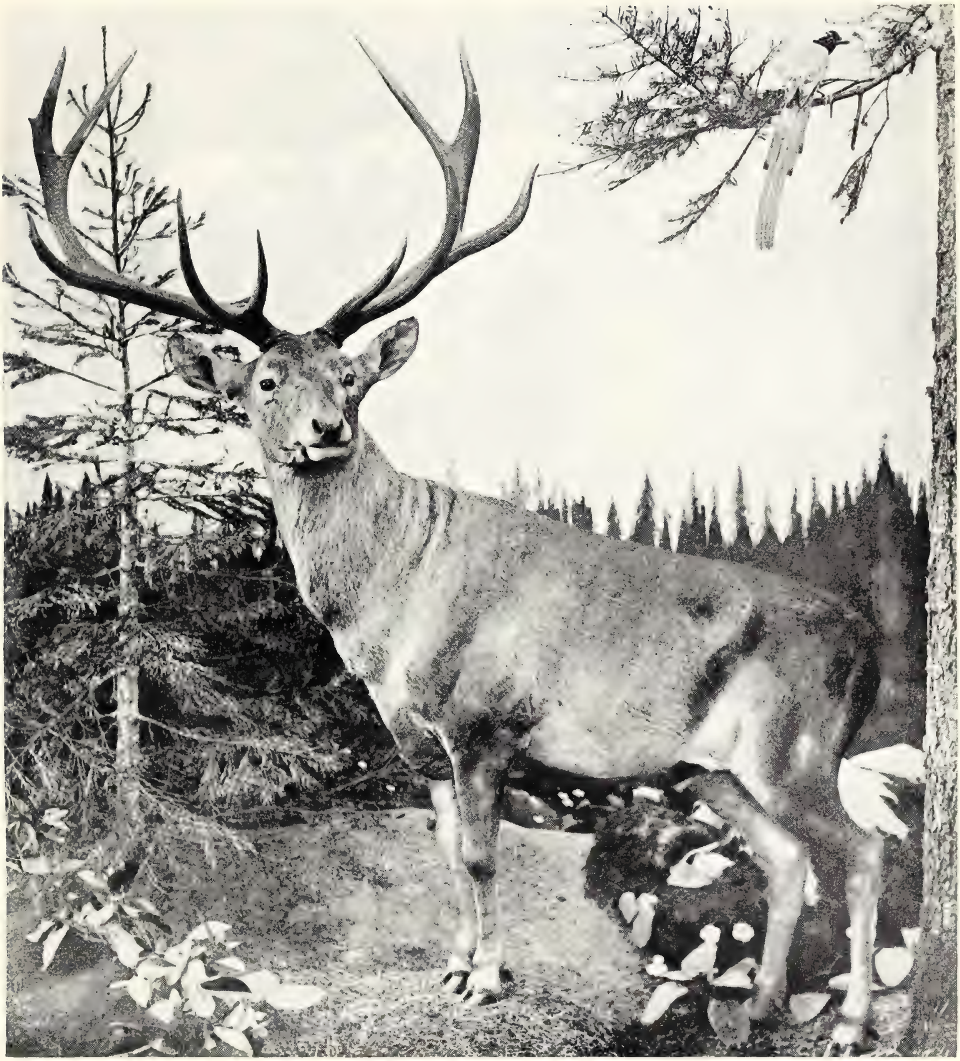
# THE KASHMIR STAG OR HANGUL (*CERVUS CASHMIRIENSIS* FALC.).

The Red Deer of Europe typifies a group of large deer consisting of several species and varieties distributed over Europe, Asia, north of the Himalayas, North Africa and North America. The best known Asiatic species is the *Hangul* or Kashmir Stag. Its range is limited to the north side of the valley of Kashmir and some of the adjacent valleys.

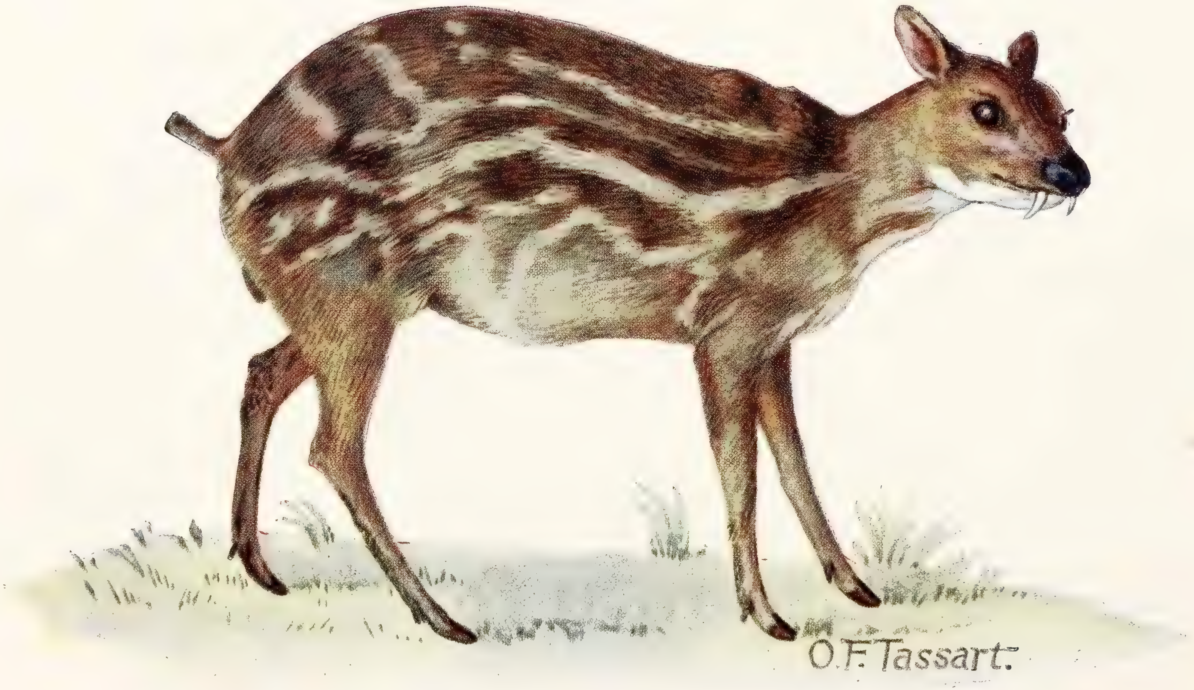
The Kashmir Stag is smaller than the Sambar. It is from 48-50 in. high at the withers. A well grown stag scales a little over 400 lbs. The coat ranges from light to dark brown, fading to dingy white on the lips, chin, underparts and buttocks. The colour fades during the summer but tones up with the denser winter coat, which, in a big stag, is very dark or rufous brown. Fawns are spotted. Old hinds may show white flecks. The fine spreading antlers assume great variety in form. Normal heads have 5 points on each antler. Heads with 16 points have been obtained, 14 pointers are rare; 13 and 11 more common.

The Kashmir Stag is essentially a forest animal. These deer are found singly or in small parties. They seldom remain long in one area but roam from forest to forest to find good grazing. Stags shed their antlers between mid March and April. Young stags may carry their horns upto the middle of May. After shedding their antlers most stags go up hill and congregate about the snow line. They spend the summer at an elevation of 9,000 to 12,000 ft. About the end of September the stags' new antlers have hardened. They commence to roar and challenge. They join the hinds at the beginning of October and, as the rut develops, engage in conflict. The master stags collect a number of hinds whose possession is disputed by rivals. In November, when the dry leaves cover the ground, the stags desert the hinds and go to the upland meadows or into the horse-chestnut forests. In hard winters the deer descend to lower levels. They come to the lower elevations in the early spring to feed on the new sprouting grass and the budding larches. The fawns are born in April.

The Chumbi Valley in Tibet and some of the adjacent valleys of Bhutan are inhabited by another species of the Red Deer group —the Shou (*Cervus affinis*). It is also called the Sikhim Stag though its existence in Sikhim is doubted. The Shou is much larger than the Hangul, standing from 4½ to 5 ft. at the shoulder. Its antlers are longer and more massive. Their distinctive feature is the forward bend of the beam at the junction of the third tine.



The Kashmir Stag or Hangul (*Cervus cashmiriensis* Falc.).
(*Height at shoulder 48-50 in.*).



The Indian Chevrotain or Mouse Deer (*Moschiola meminna* Erxl.)

## SECTION *TRAGULINA.*

### CHEVROTAINS OR MOUSE DEER.

The cloven-hoofed animals which we have considered so far all belong to one great division—the *Pecora* or Ruminants. The Mouse Deer represent a second division. They are true ruminants and, like ruminants, have no front teeth in the upper jaw. But they differ in having a three-chambered stomach in place of one with four divisions. They have four well-developed toes on each foot, the bones of the petty or side toes being complete. In true ruminants some of these bones are imperfect or wanting. Antlers are not developed. Mouse Deer, like Musk Deer, are furnished with tusks. These are better developed in males. Mouse Deer are included in a single family the *Tragulidae* which contains three genera: (1) The Indian Chevrotain (*Moschiola*), (2) The Malay Chevrotains (*Tragulus*) and (3) The African Water Chevrotain (*Hyemoschus*). The Asiatic Chevrotains are distinguished from the African by having true cannon bones developed.

The Indian Chevrotain or Mouse Deer (*Moschiola meminna*) is a tiny little creature no more than 10 or 11 in. high. Because of its small size, shy habits and very protective colouring it easily escapes observation. Its coat is olive brown speckled with yellow. The flanks are marked with rows of buff or white spots. The lower parts are white. The throat has three white stripes. The Malay Chevrotains are distinguished from the Indian by having the skin on the chin and throat naked instead of hairy. Their coats are not spotted. There are two species in Burma—the larger Malay Chevrotain (*Tragulus canescens*) and the Lesser Malay Chevrotain (*Tragulus kanchil ravus*). The former is about 28 in. long and 13 in. high, the latter is no longer than 18 in. from the tip of the nose to the root of the tail. The smaller animal has three white stripes on its throat, the larger five. Both species are common in the forests of Tenasserim.

All Chevrotain have similar habits. The Indian Mouse Deer shelters in grass covered rocky hillsides or in forest. It conceals itself in the crevices of rocks or among large boulders, coming out to feed in the mornings or evenings and never venturing far out into the open. In these 'hides' the female brings forth her young, generally two in number, at the end of the rains or the commencement of the cold season. The males live solitary except during the pairing season. The Indian species is found in Central and Southern India. The Malay species live in dense thickets. Like the Indian species they pair in June or July.

## SECTION *SUINA.*

## PIGS, PECCARIES AND HIPPOPOTAMUSES.

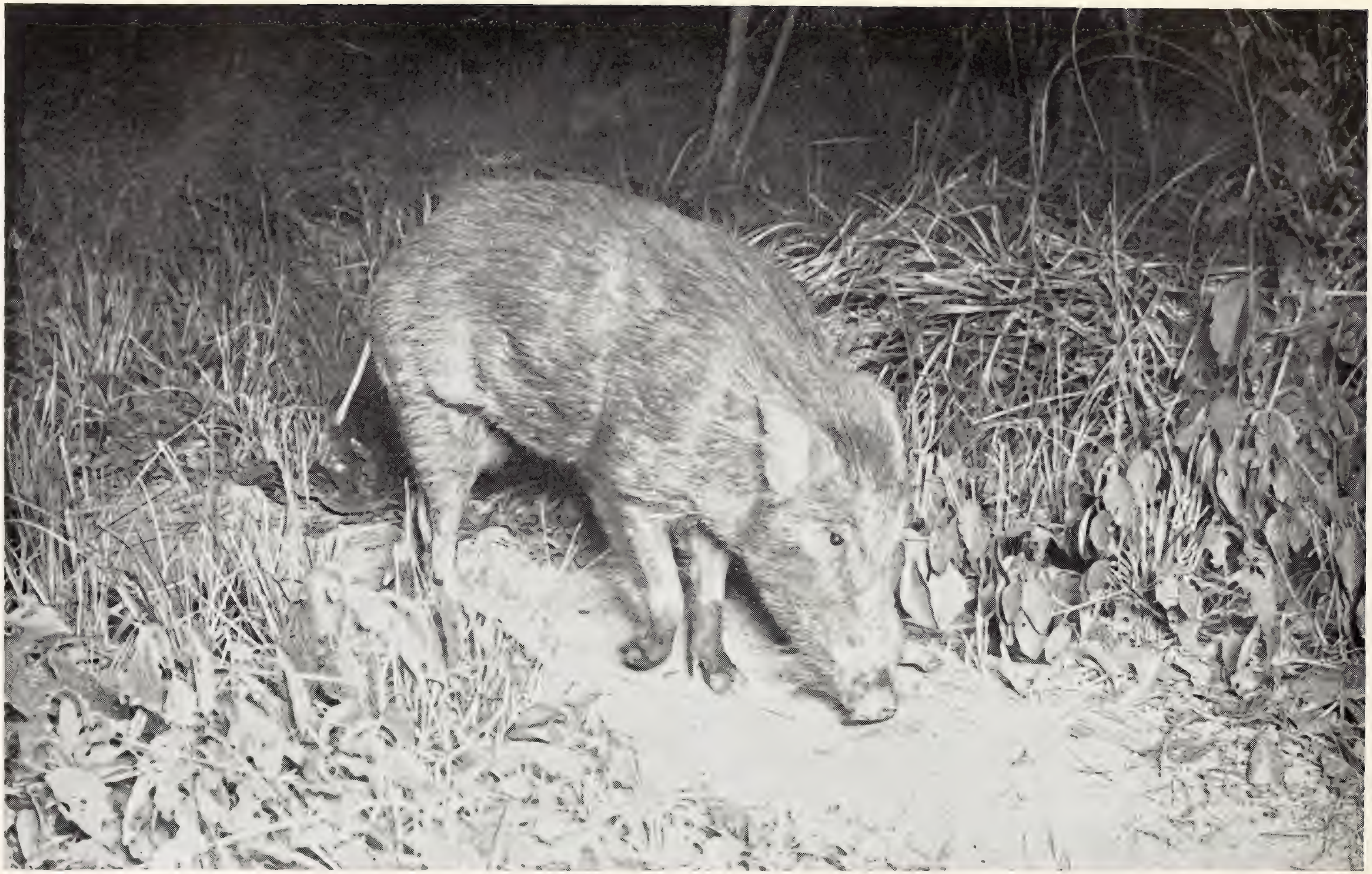
The Chevrotains represent, as was shown, a group of animals somewhat distinct from the true ruminants. Pigs, Peccaries and Hippopotamuses are a stage yet further removed from typical ruminants. They form a third section of the *Artiodactyla*. Their feet, like the feet of the Chevrotains, have the bones of the 4 toes complete. All these pig-like animals have incisor teeth in the upper jaws. Their molar teeth when unworn are capped with small hillock-like columns which do not wear down to crescentic patterns seen in the grinding teeth of ruminants. As they are not ruminants their stomachs are much less complex and may, as in the pigs, consist of a single chamber.

Finally, cannon bones are not developed in the feet, the bones which fuse to form a cannon bone in true ruminants remain distinct in these animals. These pig-like animals represent a more primitive type which existed at a time when ruminants were unknown and which formed the ancestral stock from which they have descended.

The Peccaries are exclusively American in their distribution. Hippopotami are now limited to Africa but many species once inhabited India. They were probably contemporary with the Stone Age Man in this country.

The Pigs (*Suidae*) are the only representatives of the division in our area. There are two genera: (1) the Wild Boar (*Sus*) and (2) the Pigmy Hog (*Porcula*). An elongate head with an abruptly truncated mobile snout, ending in a flat disc containing the nostrils is distinctive in pigs. Their feet are narrow. The petty toes are completely developed but do not reach the ground when walking. The upper canines curve upwards and outwards.

The Pigmy Hog is closely related to the typical Pigs. On account of its small size, short tail and the presence of three pairs of teats instead of 4, it is regarded as a separate genus. Though a single species of wild boar is now found in India, in the Eocene Period six or seven species inhabited the country—one of them a monster form, the largest known of its race.



*Reproduced from "The Jungle in Sunlight and Shadow."* *Copyright, F. W. Champion.* *Photo by F. W. Champion.*

The Indian Wild Boar (*Sus cristatus* Wagner).

## Family IV. *SUIDAE*, PIGS.

### THE INDIAN WILD BOAR (*SUS CRISTATUS* WAGN.).

The Indian Wild Boar is widely distributed. It ranges over nearly the whole of India, Burma and Tenasserim, Siam and part of the Malay Peninsula. It is also found in Ceylon.

A well grown male stands about 36 in. at the shoulder. It is believed to be a larger animal than the European Boar with a sparser coat and a fuller crest or mane. The weight of an adult may well exceed 300 lbs. The tusks are well developed in the males both the upper and lower curve outwards and project from the mouth. The lower tusks in a large boar are said to have measured 12 in. including the portion embedded in the jaw. But they rarely exceed 9 in.

The tame pig of India is probably derived from the wild. The two probably interbreed when opportunity offers. The colour is black mixed with grey, rusty-brown and white hairs. The young are browner and old boars greyer. New born wild pig are brown with light or dark stripes.

The Indian Wild Boar lives in grass or scanty bush jungle—sometimes in forest; after the rains, quite commonly in high crops. They are omnivorous living on crops, roots, tubers, insects, snakes, offal and carrion. They feed in the early mornings and late in the evening and, where much disturbed, chiefly at night. No animal is more destructive to crops and, in cultivated areas, it is impossible to make a plea for its protection.

Wild Boar display great intelligence, and few animals show greater courage and determination. The sense of smell is acute, the eyesight and hearing moderate. Wild Boar are highly prolific. They apparently breed at all season. In Central India the majority of young are born at two periods shortly before or after the rains. Boars and sows are known to collect in large assemblies when pairing. A herd of 170 or more were seen by Mr. Dunbar Brander. They were collected in a circle, the master boars in the centre. Two males were fighting—two others had fought; the rest were passive though interested spectators. The period of gestation is said to be four months—4-6 young are born at a time. The mother shelters them in a heaped up mass of grass or branches which she builds before she litters.

After breeding the big boars live alone or in company with another of equal size or with one or two sows.

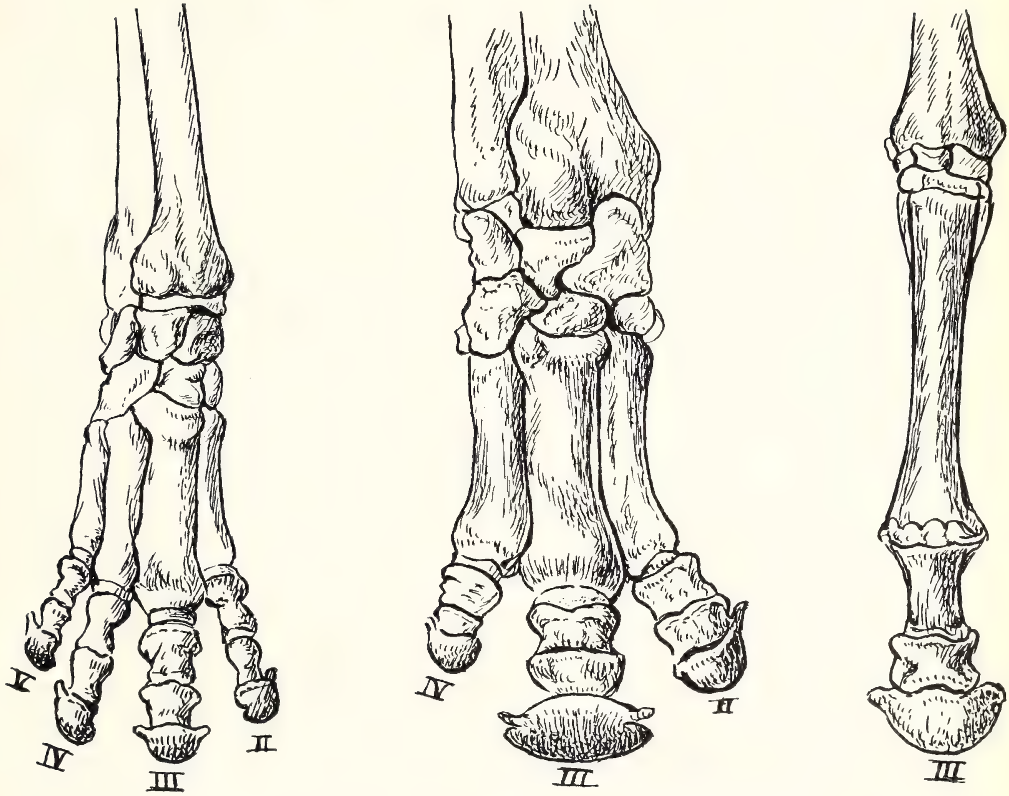
The Pigmy Hog (*Porcula salvania*) inhabits the forests at the base of the Himalayas in Sikhim, Nepal, Bhutan and in Assam. Its habits are similar to those of Wild Pig. It is said to live in herds of 5-20. It is nocturnal and rarely seen.

## *PERISSODACTYLA*: ODD-TOED UNGULATES.

It has been shown that there are four main divisions or Orders of hoofed animals and that all those considered so far, belong to the first and largest division the Artiodactyla or Even-toed Ungulates. The salient feature which distinguishes the even-toed ungulate lies in the arrangement of its toes. The axis of the foot—a line drawn down its middle—passes between the third and fourth toes. These two toes are large and equal in size. The hoofs which encase them appear like a single hoof cleft in two. This prominence of the third and fourth toe is accompanied by the diminishing in size of the second and fifth and the complete disappearance of the first toe. This is the general plan of structure in the feet of oxen, sheep, goats, deer and pigs.

With Horses, Rhinoceroses and Tapirs we come to an assemblage of animals differing in many important respects from those so far described. Their most obvious distinction is again displayed in the structure of the feet. Like the even-toed ungulates they are descendants of 5-toed ancestors. But with them it is the third or middle toe of the foot which has increased in size at the expense of the others. The number of toes varies. A Tapir has four and a Rhinoceros three toes on the fore feet. Both have only three on the hind. The foot of a horse has but one functional toe. But in all these animals it is the third or the middle toe of the foot which is most prominent. It is always symmetrical in itself and always larger than the other toes, when these are present. This pre-eminence of the third or middle digit of the foot gives this group of animals its name—*Perissodactyla* or Odd-toed Ungulates. With them, except in the case of the Tapirs, the number of toes in each foot is usually odd—either one or three. The Odd-toed ungulates are further marked by having their molar and premolar teeth in one unbroken series, the posterior molars resembling the pre-molars in shape and size.

The Odd-toed ungulates are poorly represented at the present day. Horses, Rhinoceroses and Tapirs are the only surviving members of a group of animals which flourished in great variety during the earlier Tertiary period. With the exception of the Tapirs which are found also in Central and South America all the existing odd-toed ungulates are Old World animals.



TAPIR. RHINOCEROS. HORSE.

The bones of the forefoot of the three animals are shown: the Horse with 1 digit, the Rhinoceros with 3 and the Tapir with 4. In all of them the 3rd or middle digit is symmetrical in itself and much more developed than the other digits.

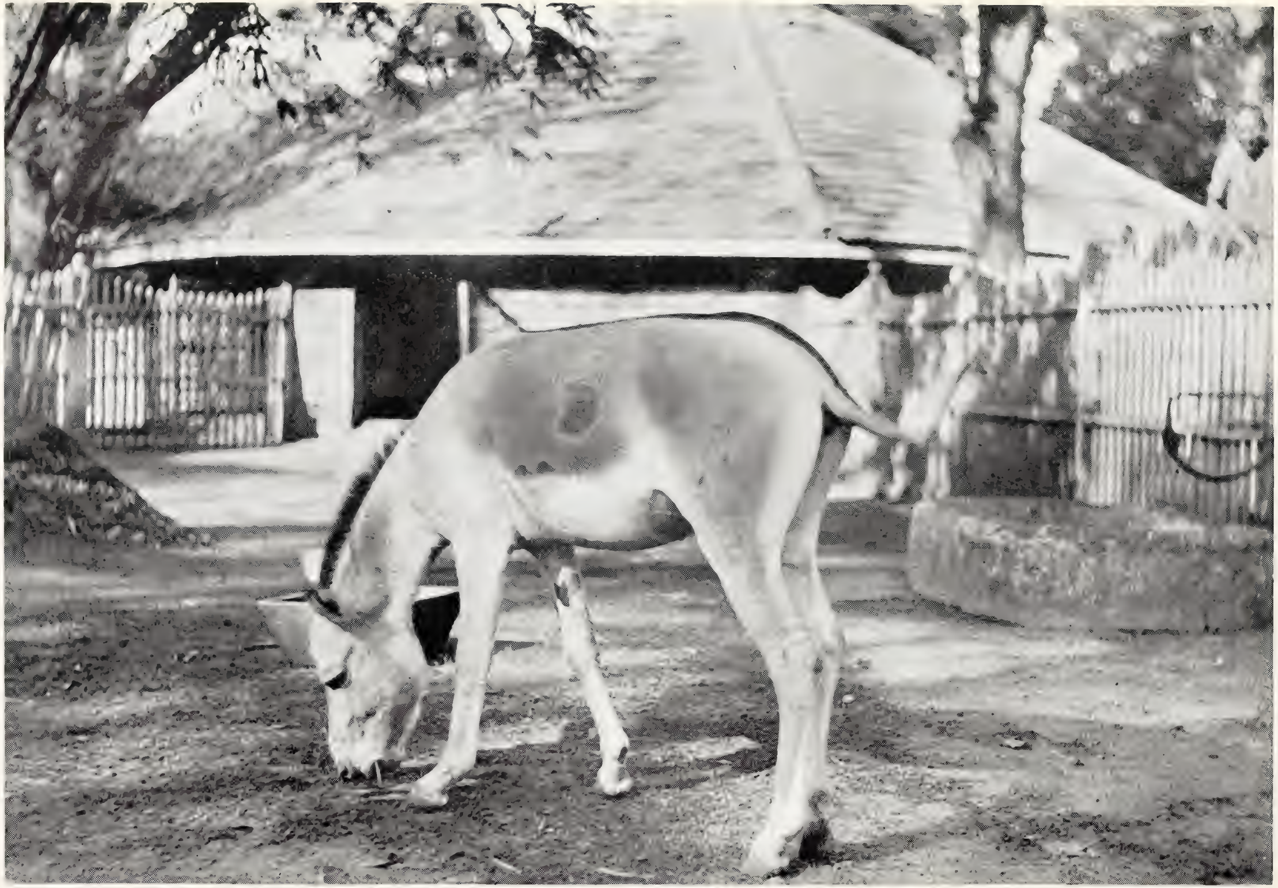


*Photo by* *C. McCann*

The Indian Wild Ass (*Equus onager indicus*, Pallas).
*Height at shoulder 44-48 in.*).

## Family I: *EQUIDAE.*

## HORSES, ASSES AND ZEBRAS.

### THE KIANG (*Equus kiang* Moorcroft.).

### THE GHOR-KHAR OR INDIAN WILD ASS (*Equus onager indicus* Blyth.).

The Horse tribe includes the Asses and Zebras. In all these animals each foot has a single complete toe encased in a large solid hoof. It is supported by a long bone known as the 'cannon bone'. Small splint bones on each side of the 'cannon' bone represent the vestiges of the second and fourth toes. The cheek teeth are large, quadrangular and complex, the enamel foldings being numerous as compared with the simpler ones of the Rhinoceroses and Tapir.

In the wild state the family is confined to the plains of Asia and Africa. Two species are resident in our area. The Kiang (*Equus kiang*) and the Ghor-khar or Indian Wild Ass (*E. onager indicus*). The Kiang lives in the high open plateaus of Ladak and Tibet. The Indian Wild Ass is found in Baluchistan, Cutch and in parts of the desert zone of North-Western India. Both the Kiang and the Ghor-khar are more closely allied to the Horse than to the true wild asses of North Africa. Like all Wild Asses, they have short upright manes. Those curious callosities seen on the inside of the legs of the horse, the purpose of which is unknown are absent in the ass. The Kiang is distinguished by its large horse-like hoofs. The hoofs of the Ghor-khar are smaller and more ass-like. A Kiang's ears are comparatively short. The coat is reddish in summer, tawny grey, woolly and dense in winter. Like all wild asses it has a dark brown stripe along the back from the nape to the tail. A Kiang stands about 51-52 in. at the shoulder.

Wild asses are usually shy and difficult to approach but the Kiang is one of the most inquisitive of animals and will frequently approach within 50 yards or so of any strange object.

The Ghor-khar which is the eastern race of the Persian Wild Ass is a smaller animal than the Kiang. It is about 46 in. high at the shoulder. In summer its coat is sandy, in winter, grey.

Wild asses are remarkable for their fleetness and their capacity of getting over rough and stony ground at a great pace. As a rule these animals inhabit desert plains or as in the case of the Kiang open rolling tablelands where both desert and arctic conditions prevail.

They associate in small parties of 4 or 5. Sometimes these parties unite and form large herds. During the foaling time the Kiang mares collect in certain favoured areas while the stallions are scattered about either solitary or in twos and threes.

In the plains to the west of the Indus, Wild Asses are found wandering about for the greater part of the year but in the hot weather when the grass withers and water is scarce they migrate to the hills. The mares are said to drop their foals in July and August.

## Family II: *RHINOCEROTIDAE* RHINOCEROSES.

The various species of Rhinoceroses, all now confined to the Old World, differ remarkably from one another in structure. As a result of migrations during past epochs into different habitats and climates, into new feeding grounds to which they became adapted, the various species appear to have become distinct at a very early period of their history.

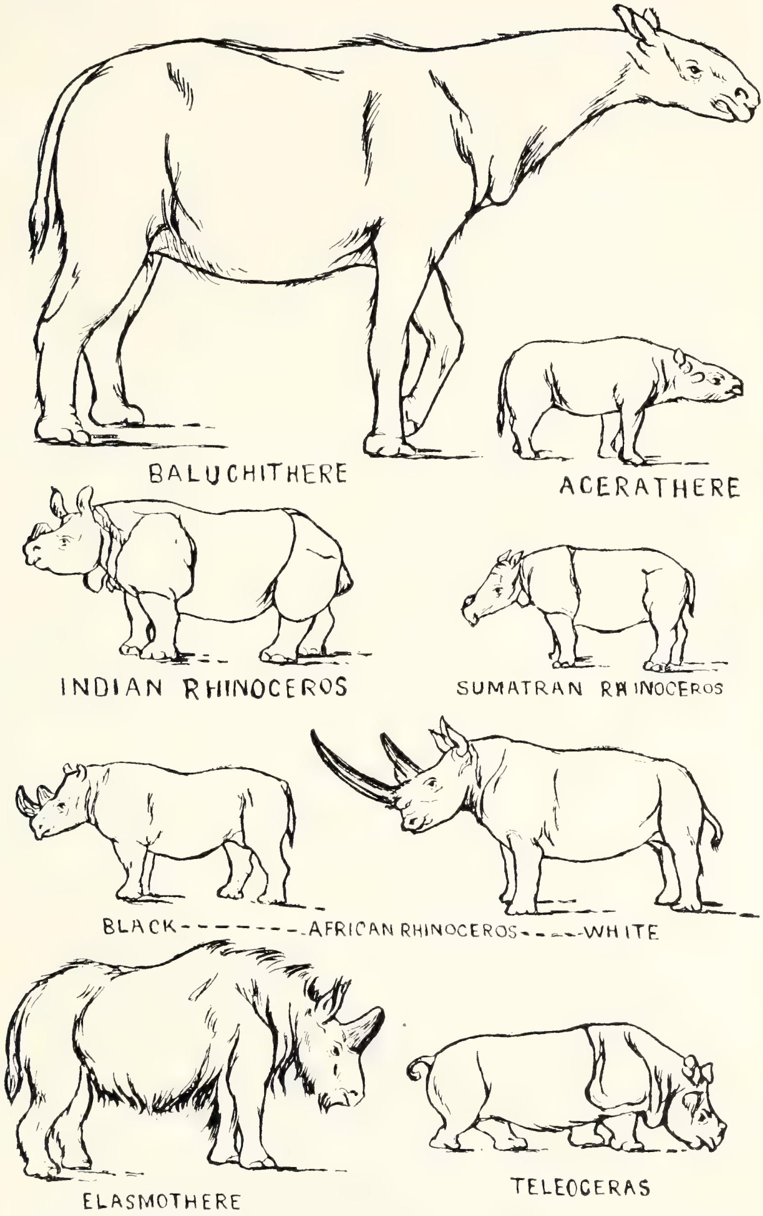
A comparison of the remains of numerous extinct forms with those now living indicates 7 distinct lines of descent and evolution from which lesser branches were given off. Though these animals are externally similar they are thus really very far apart both in history and anatomy: even the two living African Rhinoceroses probably separated from each other and became distinct species a million years ago.

Three species of Rhinoceros are found within our limits. The Great One-horned Rhinoceros (*Rhinoceros indicus*) and its relative, the Smaller One-horned or Javan Rhinoceros (*Rhinoceros sondaicus*) have an obscure genealogical history. No representatives of these true and typical Rhinoceroses have been discovered anywhere but in South-Eastern Asia. Their remains are not found in the more ancient Sivalik beds. But they appear with relative suddenness in the uppermost and more recent beds in the form of two species known as the Sivalik Rhinoceros (*R. sivalensis*) and *R. palaeindicus* the ancient Rhinoceros of India.

The Asiatic two-horned Rhinoceros (*R. sumatrensis*) was on the other hand widely distributed in the past. It was quite abundant in the Sivalik hills in Pliocene times. It was a geological period when these animals, favoured by a genial climate, inhabited a broad forest belt which stretched from the east coast of England southwards and eastward across Southern France and North Italy to India.

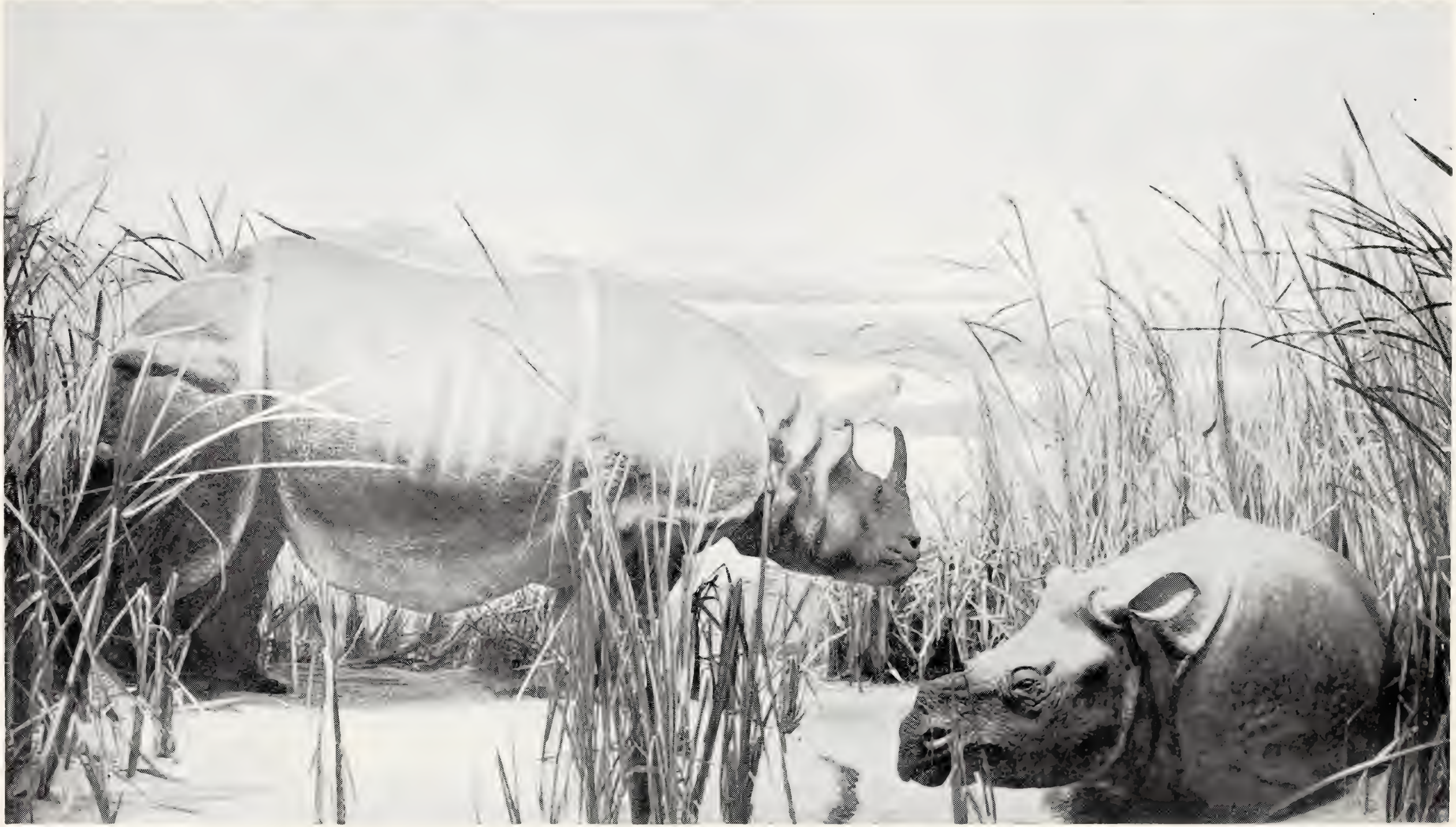
All the living Rhinoceroses are included in a single genus. Their massive build, the thickness and solidity of their bones, their short stumpy legs each furnished with three toes are some of the family characters. The skin in all the living forms is either thinly clad with hair or naked and in all the Indian species the heavy hide in places is thrown into deep folds. The nasal bones are enlarged to serve as a support for a single or double horns. When two horns are present they are situated one behind the other in the middle line of the snout. The horn is formed of a closely matted mass of horny fibre issuing from the skin. It has no connection with the skull, although a supporting boss of bone in the skull may serve as its foundation.

The horns grow throughout life and if lost are reproduced.


BALUCHITHERE
ACERATHERE
INDIAN RHINOCEROS
SUMATRAN RHINOCEROS
BLACK--------AFRICAN RHINOCEROS-----WHITE
ELASMOTHERE
TELEOCERAS

RHINOCEROSES LIVING: (*facing left*); EXTINCT (*facing right*).

The Baluchithere, an aberrant form of Rhinoceros, whose remains were discovered in the Butgi Hills, Eastern Baluchistan is believed to have been 13 ft. high at the withers. It towers above all its relatives. (*Reproduced from Natural History, Vol. XXIII, No. 3*).



By Courtes of The Field Museum, Chicago

The Great One-horned Rhinoceros (*Rhinoceros unicornis* L.).
(*Height at shoulder 60-69 in.*).

## THE GREAT ONE-HORNED RHINOCEROS
## (*RHINOCEROS UNICORNIS* L.).

The Great Indian Rhinoceros, probably the largest of all living Rhinoceroses may reach over 6 ft. at the shoulder.

The average height of a well-grown animal is about 5 ft. 8 in. with a girth of 11 ft. behind the shoulder. The skin of this massive creature is divided into great shields by heavy folds before and behind the shoulder and in front of the thighs. In this Rhinoceros the folding of the skin in front of the shoulders is not continued right across the back. The skin on the flanks, shoulders and hind quarters, is covered with a mass of rounded tubercles. With his grotesque shape, long boat-shaped head, his folds of armour, his scaly hide he looks like a monster of some byegone age. The horns of the Indian Rhinoceros never compare with those of the African. The record from Assam measures 24 in. 15-16 in. is a good average length.

The males may be recognised from the females by a shorter and thicker horn blunted by frequent combats. The female's horn is sharper and longer. Though it prefers swamp and grass the Great Indian Rhinoceros is also found in wood jungle up ravines and low hills.

The animal is solitary as a rule though several may occupy the same patch of jungle. Along the numerous rivers which flow through the jungles of the Nepal Terai the rhino has particular places for dropping its excreta. Mounds so accumulate in places. In approaching these spots a rhinoceros walks backwards and falls an easy victim to poachers. Breeding takes place at all times of the year. The period of gestation is given as 17 to 18 months. In Nepal it is generally believed to be one year. A fully developed calf taken from the uterus measured 4 ft. 1 in. and scaled 120 lbs.

The food consists chiefly of grass. In Nepal during the rains Rhinoceros frequently enter cultivation. Many legends and beliefs are attached to this animal. In Europe, during the Middle Ages its horn was generally believed to have peculiar medicinal virtues.

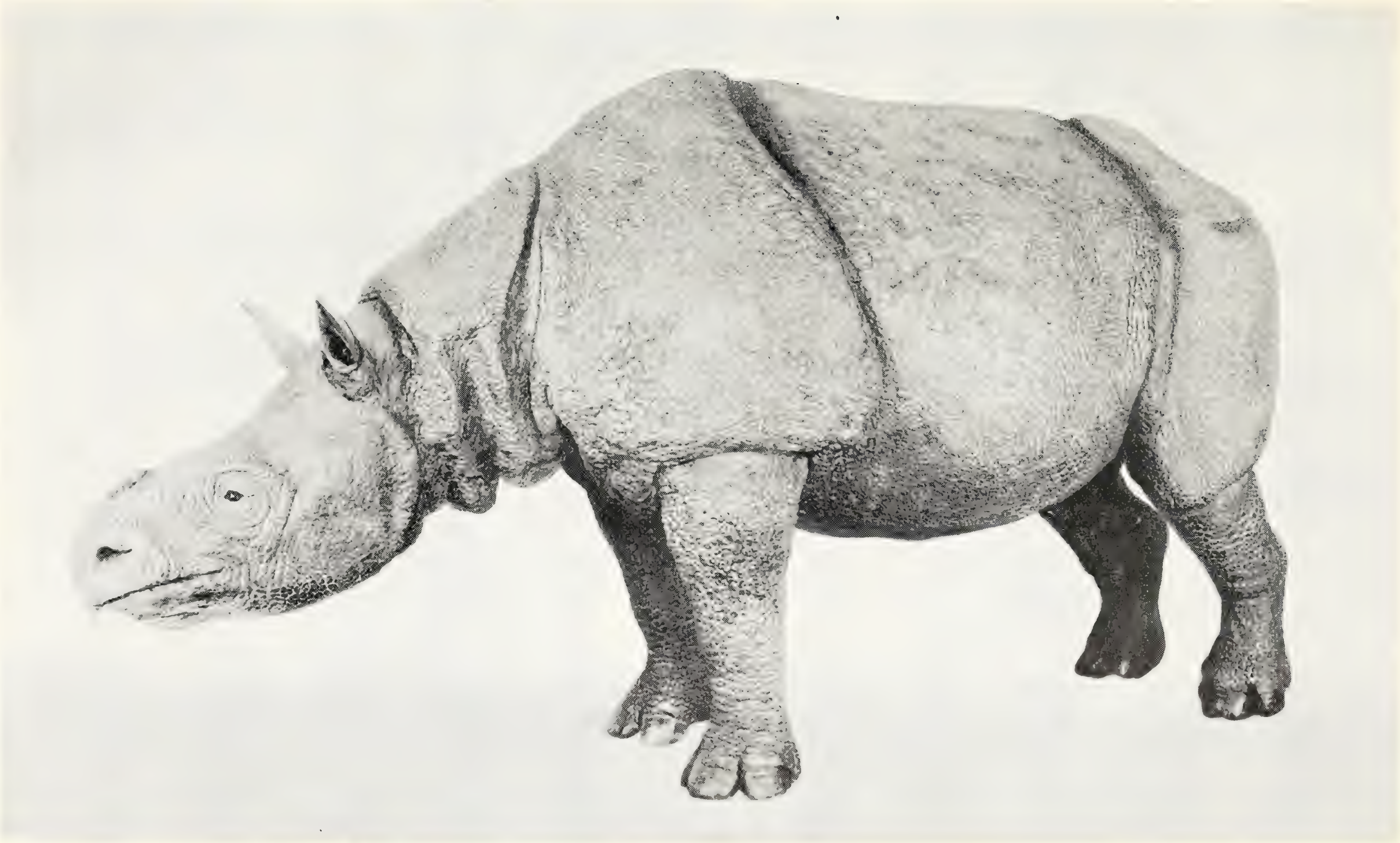
In Nepal the flesh and the blood of the Rhinoceros is considered highly acceptable to the *Manes*. High caste Hindus and most Gurkhas offer libation of the animal's blood after entering its disembowelled body. On ordinary *Sradh* days the libation of water and milk is poured from a cup carved from its horn. The urine is considered antiseptic and is hung in a vessel at the principal door as a charm against ghosts, evil spirits and diseases. These beliefs connected with the Rhinoceros are prevalent in varying form in Burma, Siam and China. They set a great value upon the animal and provide the main reason for its persecution. In Nepal, the Indian Rhinoceros is found only in the country to the east of the Gandak river known as Chitawan where strict preservation by the Nepal Government has saved it from extinction. In parts of Assam, where it is still found, strict preservation has temporarily saved it from extermination.

## THE SMALLER ONE-HORNED OR JAVAN RHINOCEROS (*RHINOCEROS SONDAICUS* CUV.).

The Javan Rhinoceros is a close relative of the Great One-horned Rhinoceros. Though smaller, it is still a very bulky animal. Old bulls measure about 5 ft. 10 in. at the shoulder. The single horn is never very long. 10¾ in. is the record. The horn does not appear to be developed in females or, if developed at all, it is only a low boss. In distinction to its relative, the fold of skin on the shoulders is continued across the back. The hide is marked all over with a mosaic like pattern.

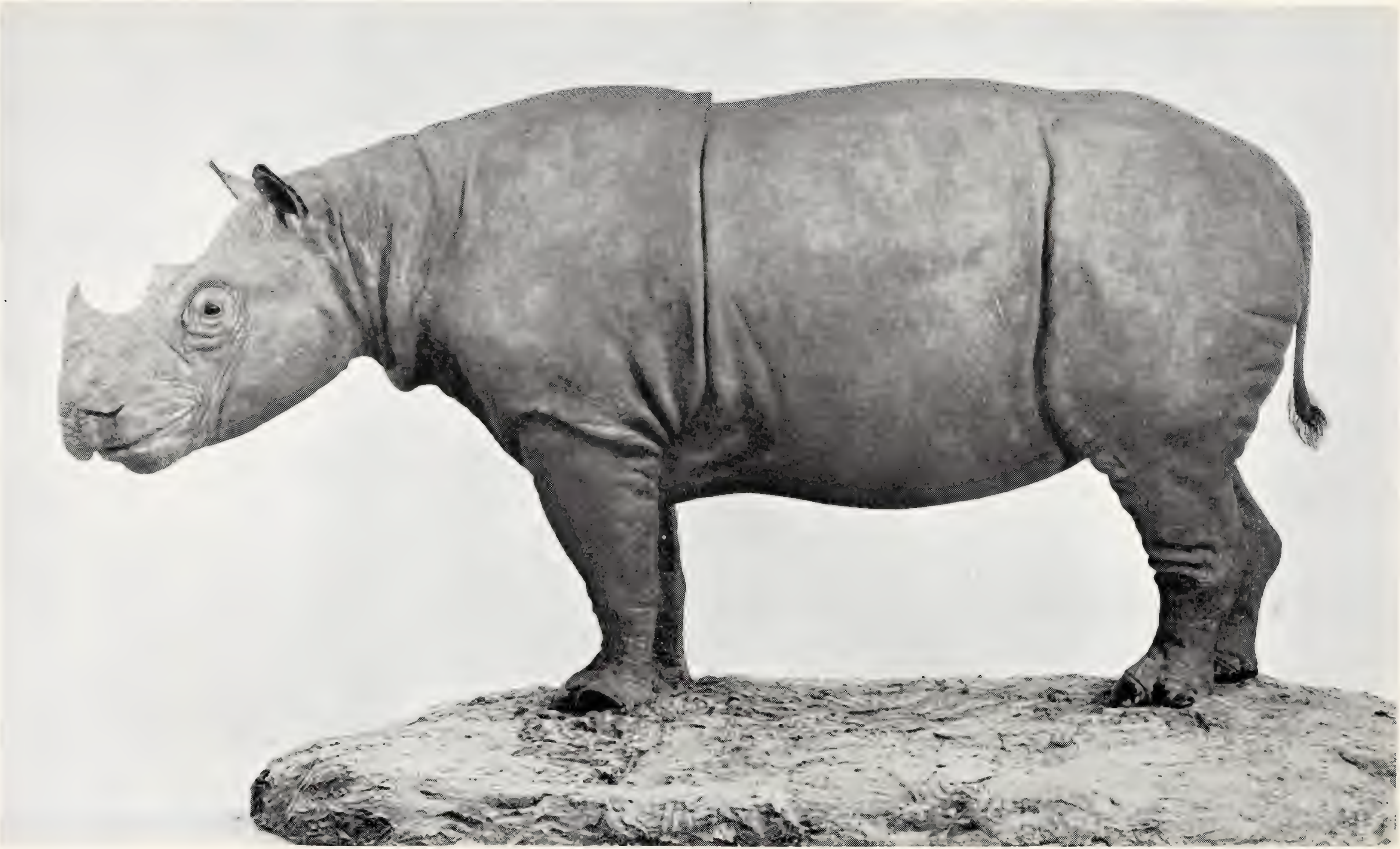
The Smaller One-horned Rhinoceros was once believed to range from Bengal and Assam through Burma and the Malay Peninsula to Sumatra. As far as can be ascertained its range is now limited to the Malay Peninsula and Java where a few still exist under protection. In earlier works on Burma, it is mentioned as having been once abundant in the forested banks of large rivers in the district of Tenasserim. Recent attempts to discover whether this rhinoceros still exists in Burma have failed and it is doubted whether there are more than half a dozen specimens and it is doubtful whether these will survive without adequate measures for their protection. Though it occurred in the Bengal Duars in former years, its presence in this area at the present time requires verification.

The Smaller One-horned Rhinoceros is more an inhabitant of tree forest than of grass land. Its low crowned grinding teeth indicate that it is a browser, indulging less in grazing than the Indian Rhinoceros, whose armoury of high crowned grinding teeth are peculiarly adapted to the mastication of grass. Its usual habitat is hill country where it has been found at elevations as high as 7,000 ft. above sea level.



By *Courtesy of* *The Brit Mus Nat. Hist.*).

The Smaller One-horned Rhinoceros (*Rhinoceros sondaicus* Cuv.)
( *Height at shoulder 70 in.*).



By Courtesy of *The Amer. Mus. Nat. Hist., New York.*

The Sumatran Two-horned Rhinoceros (*Rhinoceros sumatrensis* Cuv.).
(*Height at shoulder about 52 in.*).

## THE SUMATRAN TWO-HORNED RHINOCEROS (*RHINOCEROS SUMATRENSIS* CUV.).

The Sumatran Rhinoceros differs from the two other Asiatic Rhinoceroses in possessing two horns. On this account it is considered to represent a distinct sub-generic group (*Diocerhinus*). It is further distinguished by having a single pair of lower front teeth instead of two pairs as in the Indian and Javan animals.

The Two-horned Rhinoceros, like the Lesser One-horned species has a preference for forested hill tracts where it wanders up to considerable elevations. A sufficiency of shade and a good supply of water are essential to its habitat. A pair will frequent a given area for a time and then move off, their movements being affected by the water supply. They enter streams by night and also during the hot hours of the day. In suitable spots there are regular wallows or 'mud baths' in which the huge creatures roll much as buffaloes and pigs do. As a result of this habit their bodies are always well coated with mud. Tracks lead off in all directions from these 'wallows'. They present the appearance of large tunnels hollowed through the dense undergrowth. Unlike the elephant, a rhinoceros does not break through the jungle but burrows his way through the dense tangle. They visit the wallows singly or a bull and a cow may be found together. The night and early morning is spent in wandering about and feeding; the hot hours of the day in rest in some cool and shaded spot. In the cold weather and rains they visit the low country coming down in search of particular foods. They are not grazers but browse on twigs, shoots and are very partial to fallen fruit:—wild mangoes, citrous fruits and figs.

The sense of smell and hearing is acute but the sight is poor. Collections of dung found at particular places reveal a habit similar to that noticed with the Great One-horned Rhinoceros.

Little is known about their breeding habits but it is known that the young remain with the mother to a fairly advanced age.

The Two-horned Rhinoceros was once fairly common throughout Burma—it also occurred in Assam from which province it is now practically exterminated. At the present time a few inhabit the forests of Lower Tenasserim and the hill tracts about Myitkyina, the Arrakan Hills and the Pegu Yomas. A small number are present in the Shive-u-daung Sanctuary in the Mogok division of the Katha District where proper protection may save this species from extinction in Burmese limits.

## Family III: *TAPIRIDAE*: TAPIRS.

### THE MALAY TAPIR (*TAPIRUS INDICUS* CUV.).

The third and least specialised family of surviving Odd-toed Ungulates contains a single genus—*Tapirus*, the Tapirs. Tapirs differ little in their anatomy from their fossil ancestors and appear to have retained their primitive character even to our times. In the remote past they probably inhabited, as they do now, the deep recesses of the forest. Such protected environment is never favourable to rapid evolution but rather to persistence of type. We see this exemplified in the Two-horned Rhinoceros, like the Tapir, a creature of dense forest which shows little change in its anatomy as compared with the Two-horned Rhinoceros of past geological epochs.

Tapirs differ from all odd-toed ungulates in having 4 toes on the front feet. Their hind feet as with the Rhinoceros is three-toed. The three large toes of the fore foot correspond to the three middle fingers of the human hand. The little outer toe represents the fifth finger.

The cheek teeth have two simple transverse crests on their crowns, very different from the complex enamel foldings of the teeth of rhinoceroses and horses.

A heavy ungainly body, short stout limbs, a muzzle lengthened to form a short trunk, small eyes, oval ears and stumpy tail, all give the Tapir a peculiarly antedeluvian appearance.

Tapirs once inhabited Europe and from thence they appear to have migrated southwards. One group reached the New World where they still survive in Central and South America and the other passed down into the Malay countries.

The Malay species is very distinct from its American relations. It is larger and has a bi-coloured coat. The head, limbs and front part of the body is brownish black, the rest of the body behind the shoulders is greyish white. The American Tapirs are uniform brown. The young of both animals are striped. The Malay Tapir stands from 3-3½ ft. at the withers and slightly higher at the rump. The species is confined to Sumatra and the Malay Peninsula and only enters our limits in the south of Tenasserim. Here it lives in densest forests and has many of the habits of the rhinoceros browsing on leaves and twigs and visiting wallows. It is a water loving creature and swims and dives well. A pair of Tapir in captivity displayed a habit of carefully concealing their droppings. Copulation took place in the water. A single young was produced. The period of gestation was 9 months.

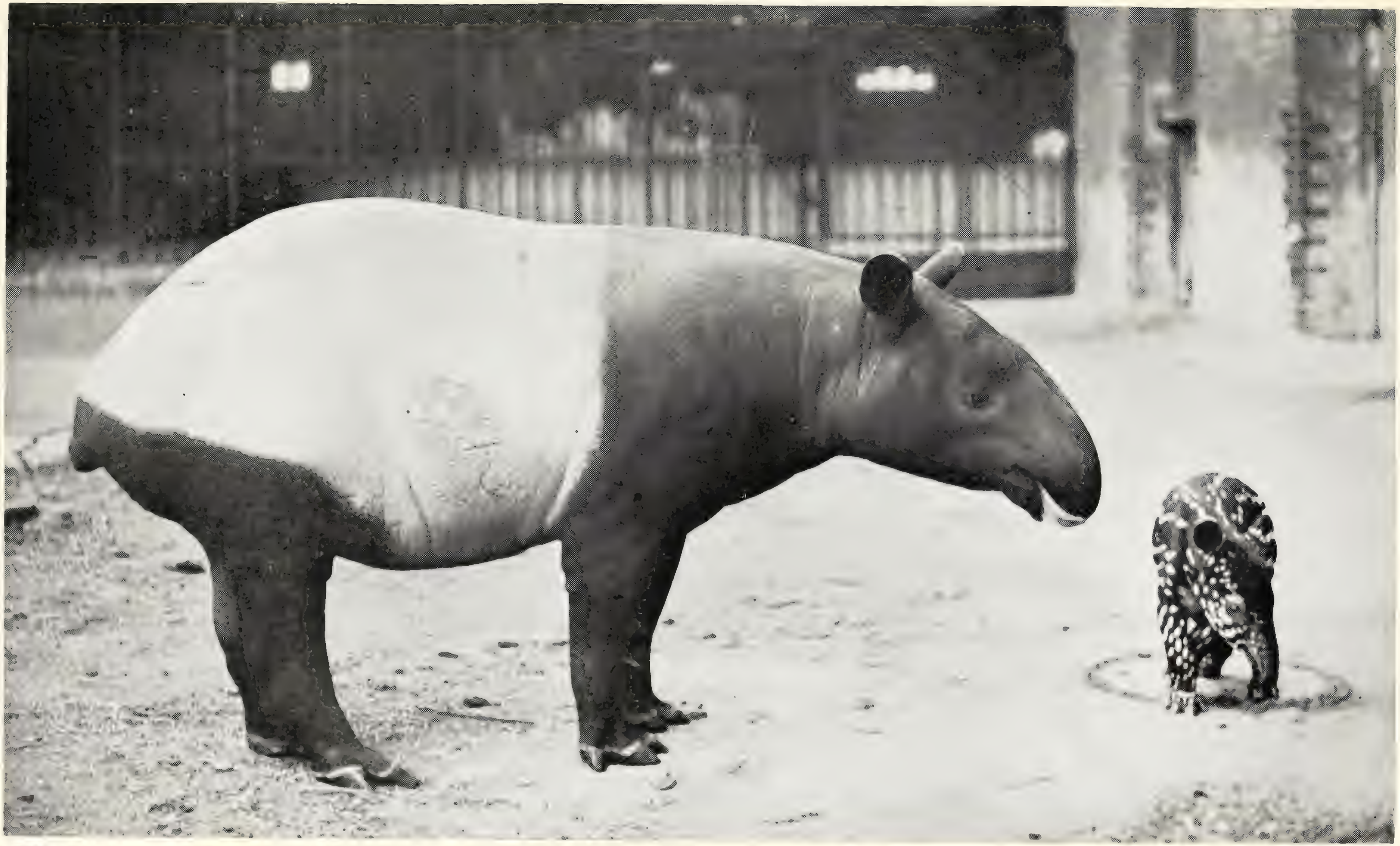
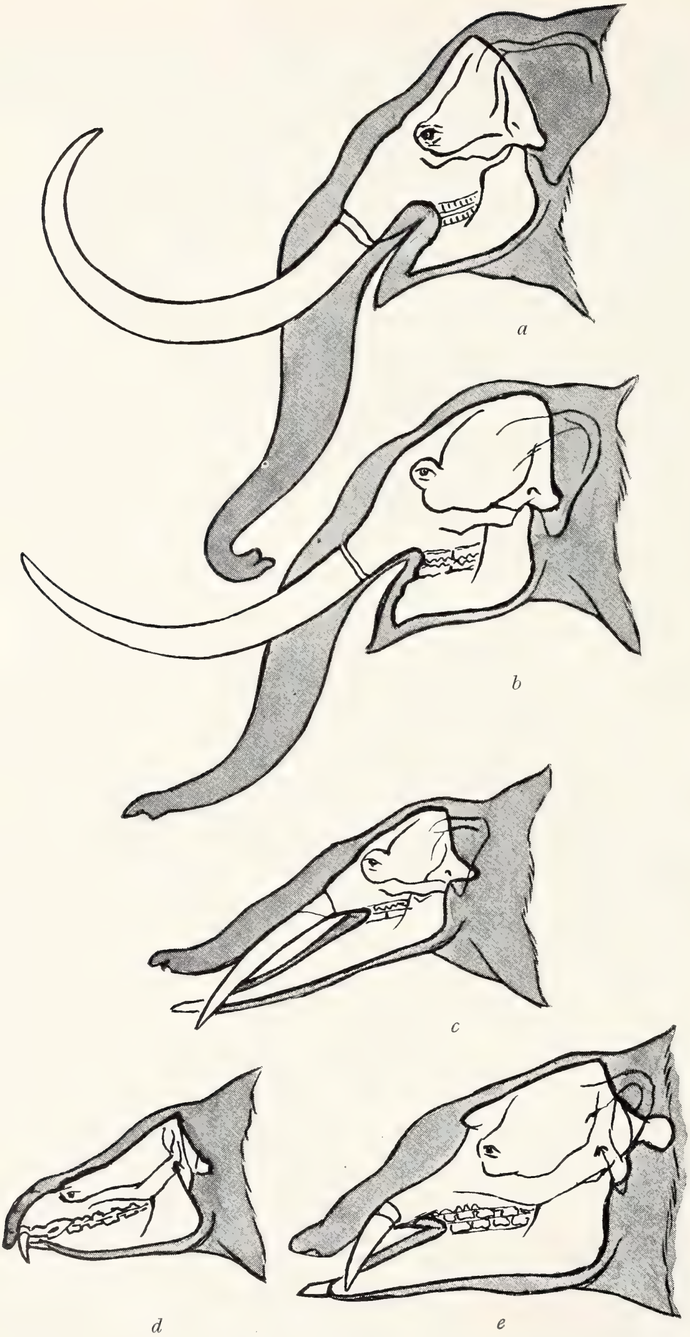


*Photo by* *W. S. Berridge.*

The Malay Tapir and young (*Tapirus indicus* Cuv.).

*Height at shoulder 36-42 in* ).



Evolutionary changes of Proboscidea. Based on restorations modelled by R. S. Lull.

a. *Elephas columbi* ; b. *Mammut americanum* ;
c. *Tetrabelodon angustidens* ; d. *Moeritherium* ;
e. *Palaeomastodon*. (*Reproduced from Ann. Report, Smithsonian Institution, 1909*).

## *PROBOSCIDEA*: ELEPHANTS.

The proboscis or trunk of the elephant gives the name Proboscidea to this the fourth and last order of Ungulates. There are but two species of elephants in existence—the Indian and the African. They are the sole survivors of a great assemblage of species which once inhabited the earth. No fewer than seven species of elephants and 8 different Mastodons are known to have existed in India during remote geological periods.

With its pendant trunk, its curious dentition, and its great size the elephant presents distinctive characters which differentiate them from all other mammals. However remarkable these characters may be, they are the ultimate results of a gradual deviation from a standard type of mammal—a hairy creature of no great size walking on the soles of its five-toed feet and carrying in its jaws the typical complement and number of incissor, canine and molar teeth. A comparison of existing and extinct forms of elephants and their allies has helped to indicate the great physical changes which the race has undergone during the long ages of its history. Changes which have been brought about largely by migrations to new countries and the new condition of life which they imposed. These migrations were impelled not only by the natural urge of the creature to extend its territory but also by actual changes in the earth's surface which bringing about a difference in climate and vegetation forced the ancestral forms to migrate into areas where conditions of life were more congenial. The physical modifications which elephants display are seen firstly in an increase in size. This necessitated the development of pillar-like limbs to support the enormous weight of the body which again implied the straightening of the limb bones and a change in the angle of their articulation. The foot itself changed its posture from the primitive plantigrade position. The heel and ankle bones were elevated above the ground and a thick pad of gristle developed beneath each foot and so formed a cushion to receive its share of the weight. The toes were embedded in the common mass of the cylindrical foot and encased in a common skin. Their position is indicated externally by broad flat nails which may be fewer than the number of toes. Thus, the limb bones gradually developed into vertical shafts through which the weight of the body was transmitted.

The shortness of the neck and the height of the head from the ground necessitated the development of a proboscis or trunk—a combined and lengthened nose and upper lip—as a device for securing food and water. Its development was accompanied by marked changes in the character and form of the skull. The skull of an elephant shows no 'snout'. The bony part of the face is almost straight. But it would appear that the ancestral elephants had a longer face—a prolonged bony snout more in conformity with the standard mammal skull. This is seen to some extent in the skull of the American Mastodon and to a more remarkable degree in a yet more ancient form of Mastodon—the *Tetrabelodon*. The creature had an extraordinary lengthened lower jaw furnished with two horizontal tusks. These tusks were additional to a downward bent pair in the upper jaw. Its trunk must have rested horizontally on its lower jaw between the tusks. It was not a pendant trunk but an elongated upper lip. It is believed that an elephant's trunk originated in this way. Firstly by the great elongation of the lower jaw producing a corresponding lengthening of the proboscis to reach to the need of the tusks and then by a shrinkage of the lower jaw and the straightening of the bones of the face. The long proboscis was no longer supported by the lower jaw. Gradually dropping as the lower jaw receded, in the course of successive ages, it at last hung down as a pendant trunk.

Other physical changes undergone by elephants are seen in increase in the size and complexity of the teeth, their consequent diminution in number and the development of a peculiar method of tooth succession. All the canine teeth have been lost and all the incisors, except the second pair in the upper jaw. These have developed into tusks. As to the grinding teeth an elephant develops 6 molars in each jaw during its life time. But the jaws are so short and the grinders so large that there is never room for more than two—one entirely and the other partly exposed above the gums. The new tooth forms in the rear of the jaw. Pushing forward it gradually replaces the preceding tooth which, as it wears away, is crowded out of the jaw. The first milk molar appears at the age of two weeks, it is shed at the age of 2 years, the second is shed at the age of 6, the third at 9, the fourth (or first adult tooth) between the 20th and 25th year, the fifth at 60 and the sixth lasts for the remainder of the creature's life.

Each molar is larger than the one which preceded it. Its structure has no parallel in the teeth of other animals. It is made up of a series of plates each composed of a flattened mass of dentine invested by a layer of enamel, the whole bound together in a solid mass by cement. As the dentine wears the harder enamel appears in a series of transverse ridges across the crown of the molar. The number of these ridges varies. In the Indian elephant the last or 6th molar may show 27 of these ridges. In the African species the number never exceeds 11. The African elephant is larger than the Indian. It has enormous ears, a hollow back and only three nails on each hind foot. There are 4 in the Indian species. The trunk ends in two equal sized 'lips'. The Indian elephant has but one.

The *Proboscidea* form a single family the *Elephantidae* which includes but one living genus.

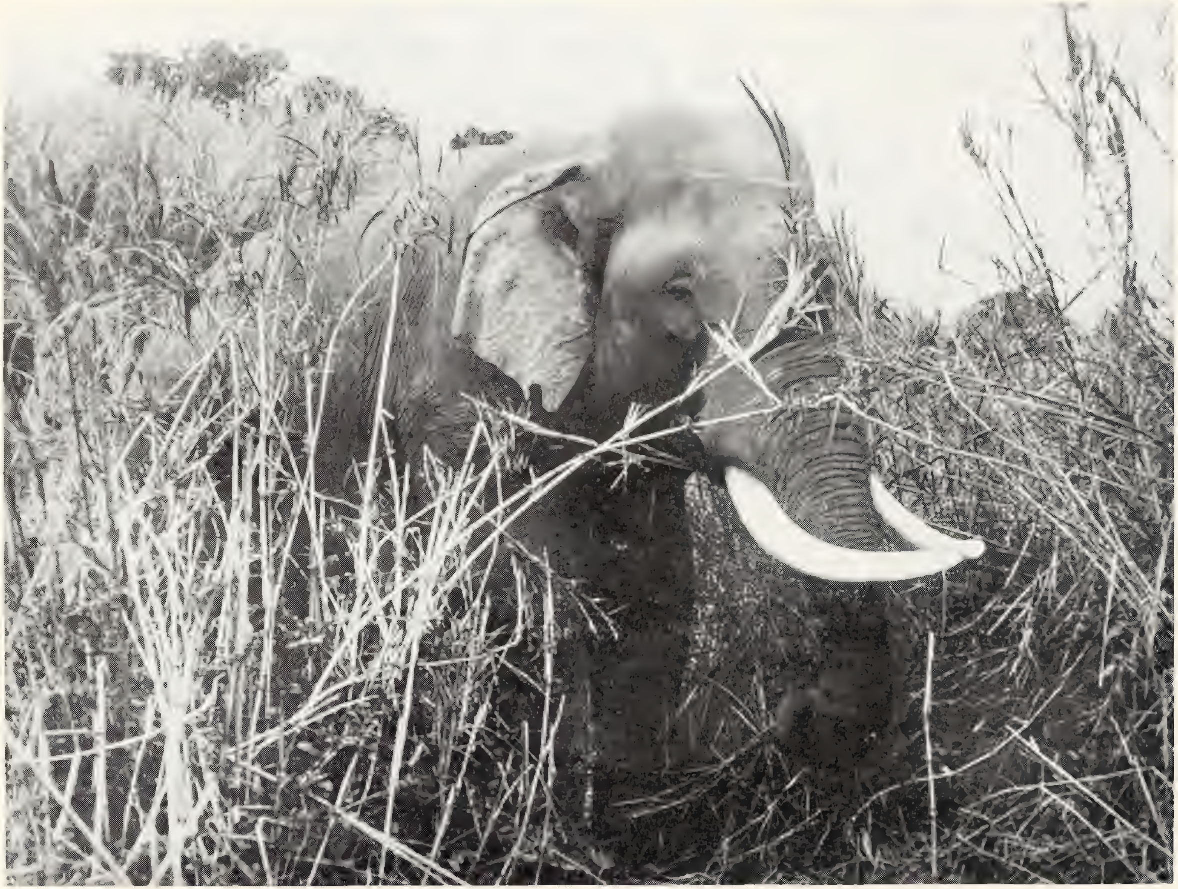


Photo by W. S. Thom.

The Indian Elephant (*Elephas maximus indicus* L.).

## THE INDIAN ELEPHANT (*ELEPHAS MAXIMUS INDICUS*).

The Indian elephant rarely exceed 10 ft. 6 in. at the shoulder. The average height of an adult male is 9 ft. The female is a foot lower. Twice the circumference of an elephant's fore foot gives a fair indication of its height. The rule does not apply always in the case of young and growing animals.

Generally only the males have large tusks. The tusks of females scarcely protrude or perhaps protrude a few inches. In some males the tusks are no longer than in females. Many of these tuskless males or *maknas* are very large in build with extraordinarily well developed trunks. The contour of the tusks varies. In some elephants they are wide spread and curved, in others straight and pointed downwards. A pair in the Royal Museum at Siam taped 9 ft. 10½ in. A pair in the possession of H.M. the King measures 8 ft. 9 in. and 8 ft. 6½ in. and weighs 160 and 161 lbs. respectively. The elephants found in Ceylon are regarded as a separate race (*E. maximus zeylanicus*). The males carry quite normal tusks. The females are tuskless. A few big tuskers shot in Ceylon are believed to be the descendants of elephants introduced from India.

The Indian Elephant has normally five nails on its fore foot and four on its hind. The outside nails are comparatively small and crinkled and their impression is only traceable in very wet soil. Ordinarily the imprint of at most three nails is to be seen and that only on soft ground. The colour of the elephant is greyish black. The chest, forehead and ears are often covered with flesh coloured spots.

An elephant usually moves at a walking pace, when alarmed or annoyed it breaks into a shuffling run. The huge creature can attain a wonderful speed and when 'all out' may travel at quite 20 miles an hour. Despite its bulk the elephant is wonderfully active going up and down steep hill sides with ease. It is an excellent swimmer and in deep water swims with practically the whole body except part of the head and trunk submerged.

Elephants chiefly frequent districts covered with tall forests where the ground is hilly or undulating and where bamboos grow in profusion. They are extremely adaptable and will live in steamy humid jungle or in cool elevated forests. In Burma they wander at all seasons of the year into bamboo forest at a height of 10,000 ft. while in Sikkim, their tracks have been seen in the snow 12,000 ft. above sea level. In the dry season the herds generally keep to the denser forests but during the rains come out into open glades and frequently enter cultivation. Individuals of various sizes and ages associate in herds which may vary from 5 to 60 or more animals. Herds are believed to be composed of single families. Different herds do not mix but stray females and young males may migrate from one herd into another. When fodder is scarce, the larger herds break up into small parties, which reunite when conditions are favourable. The big tuskers are usually seen feeding at some distance from the main herd. The bulls when they arrive at a certain age, live as solitaries or, two males of equal age may associate together. A solitary bull will graze with a herd when it happens to be in the same patch of jungle and will seek the herd when the urge to mate is on it and desert it again when its desire is appeased. When travelling elephants move in single file, the tuskers generally bringing up the rear. The leader of a herd is invariably an old female. Herds travel to and from their feeding grounds by well worn paths, wandering from them when the terrain is favourable but returning to these fixed paths, which generally follow the easiest and straightest line across the country and represent the accumulated wisdom of generations of travelling elephants. When undisturbed, the herd pursues a regular and ordered routine, drinking and feeding in accustomed places and lying up to rest in its usual retreat. They sleep during the hot hours of the day, being intolerant of the sun, feed early in the morning and evening and come out after nightfall to feed in open forest or to raid crops; retiring to sleep after midnight. An elephant rests standing or stretched out on its side. The food consists of various kinds of grasses and leaves, stems and leaves of wild bamboos and plantains, all species of crops and the bark of particular kinds of trees. A full grown elephant will eat from 600-700 lbs. of green fodder in a day.

Male elephants, very rarely females, both tame and wild, on attaining maturity are subject to peculiar periodical paroxysms of excitement known as '*musth*'. *Musth* seems to have some connection with the sexual functions. It is probably analogous to the 'rut' in deer. It occurs most frequently during the cold season and may perhaps be due to ungratified sexual desire. In some cases this is not always so since the society of a female will by no means quell or pacify the animal. At other times an elephant in musth will seek a mate.

The exact breeding season is uncertain but as most of the young are dropped in the late autumn and the period of gestation lasts about 20 months it is probable that the main breeding season is during the hot weather and at the commencement of the rains. One calf is only born at a time though, in rare instances twins and once, even triplets have been recorded. The mother of a young calf is invariably assisted in caring for her young by another female who takes on the duties of a guardian and is as assiduous in her care of the calf as its parent. A new born calf will walk a few hours after birth. In height it averages about 2 ft. 10 in. It suckles with its mouth and when alarmed takes refuge under its mother's body.

Elephants have a very poor sight, the sense of smell and hearing is highly developed, more so than in most animals. Much mystery is attached to the deaths of elephants. They are reputed to seek out some solitary and secluded spot to which they retreat when they feel their powers failing and death approaching. The legend is widespread, though it remains to be substantiated. The fact that dead elephants are seldom found may be explained firstly by the infrequency with which deaths must occur among such long lived animals and secondly by the rapidity with which decomposition in a tropical climate will remove all traces of the carcase. There are some instances on record where other elephants have attempted to move or have actually moved the dead body of a companion.

# THE PRESERVATION OF WILD LIFE IN INDIA.

## No. 3. *ASSAM.*

BY

A. J. W. MILROY.

(*Conservator of Forests, Assam*).

The question of affording adequate protection to game in Assam is a difficult one that we cannot expect will receive much local attention just now with so many important political changes staged for the immediate future, but in view of the imminence of these inevitable changes in administration it might be undesirable to postpone any longer the consideration of what system of preserving the fauna, whether the present one or something on different lines, will be most likely to survive the introduction of provincial autonomy.

Up to thirty years ago there were still very extensive unoccupied tracts in the Province, the first to disturb them being Gurkhali buffalo-keepers who began then to invade Assam with their herds, to be followed by ever-increasing hordes of immigrants, after the Brahmaputra Valley had become linked to Bengal by the railway.

Rules regarding close seasons had been framed at an early date for the Reserve Forests in conformity with practice in other parts of India, but game remained entirely unprotected in the waste lands known as Unclassed State Forests, until about 1910 when close seasons were introduced following a letter to *The Times* by Sir Harry Johnston on the indifference shown by Provincial Governments in India to the fate of their wild animals; but as no fees have ever been charged for shooting in the Unclassed Forests, there have been no funds for the maintenance of a special patrolling or protective staff, and the protection afforded by the rules alone has consequently been very meagre.

### *Types of Game Country.*

Enormous areas of grass and reeds used to extend from the banks of the Brahmaputra towards the hills which enclose the valley on both sides, and it was here that most game used always to be found—rhinoceros, and swamp deer in the low-lying places, elephants, bison, and other deer nearer the hills—but these are precisely the very localities that attract the buffalo-herdsmen and the settlers, so that a great deal of this type of jungle has now disappeared for ever and it is only a matter of time before the most of the balance goes too. In these circumstances the policy adopted a few years ago of issuing gun-licences almost indiscriminately has only accelerated what was bound eventually to take place, and what has already occurred in all countries suffering from, or blessed (as the less far-sighted hold) with, an increasing human population.

Most of the former great shooting grounds are thus being occupied exclusively by Man and nothing can be done in them for wild animals. There remain for consideration the Reserve Forests, which have been taken up mostly for timber, but which include as Game Sanctuaries two important grassy areas.

Dense, evergreen forests contain comparatively little fodder suitable for game animals, which prefer the more open and the deciduous tree forests, but everywhere in Reserves reasonable game preservation should be looked for, seeing that the sale of shooting permits is a possible source of revenue, that rules exist for the benefit of the various species of animals, and that a Forest Staff is provided by Government to uphold these and other Forest Laws. It must be confessed, however, that in Assam just as in Burma, judging from some recent Annual Forest Administration Reports from that Province, game preservation is largely a matter of individual whim, and that encouraging results obtained by one Divisional Forest Officer are only too often dissipated during the regime of a successor, who is indifferent to this side of his multifarious duties.

The present Government cannot be accused of lack of keenness. Three years ago, a British Officer and a Company of Assam Rifles were detailed to spend six weeks touring a district where the inhabitants had got out of hand and were poaching in the Monas Game Sanctuary on a commercial scale, while at the present moment an energetic Assistant Conservator is on special duty at the head of an anti-poaching campaign that is doing some very good work indeed. The Assam Legislative Council have recently declared Rhinoceros horns to be forest produce wherever found, it has become much easier to deal into the trade in these, as horns are now liable to seizure unless their possession can be satisfactorily accounted for. No help from the centre, however, can make up for lack of interest on the part of the officers on the spot, though an enthusiastic Conservator can do much to overcome apathy, thanks to the tradition of loyalty in the Forest Service, but to be really effective he must possess both the time and the inclination to tour 'off the map' and away from the usual comfortable, stereotyped marching routes.

At the worst a certain amount of game of most sorts will linger on in the larger Reserves for some time yet, but not in the smaller ones which can be easily raided, and from which animals are always straying into settled lands bristling with guns: at the best, if the Forest Department does not depart from the policy of recent years as regards Forest Villages and as regards demanding the co-operation in these matters of its subordinates, quite a fair number (in some places sufficient to allow of restricted shikar) of the more interesting species will survive in suitable localities within the forest boundaries.

Increased pressure on the outside land being likely to lead to a demand for catastrophic disforestation of cultivable areas inside the Reserves, it would appear to be advisable to proceed cautiously, when and where needs be, with the formation of Forest Villages, especially of non-resident villages which luckily for wild animals are preferable from the utilitarian point of view, as they do not waste good forest land in hamlet sites and cattle-grazing grounds. Forest Officers in Assam will always be dependent on elephants for getting really inside their forests, and this again is lucky for the game, because it is essential permanently to set aside from settlement adequate and inviolable elephant grazing grounds while there is yet time, for want of which provident measure other Provinces have had to plant fodder at considerable expense for their Government elephants.

It would be illogical to allow villagers to grow crops in a forest and then to withhold from them the means of guarding the same, but the practice lately enforced of calling in guns for safe custody after the harvest is over is only logical and reasonable, and prevents the villagers from degenerating into professional poachers, as some of them have become in the past.

It had been intended, in order to obtain complete control, to acquire on behalf of Government all the guns owned by Forest Villagers for temporary issue at the right time, together with any others that might be necessary, but this measure has had to be postponed until funds become available again.

### *Game Sanctuaries.*

The two Game Sanctuaries of which mention has been made are situated, the Monas towards the north-west on the Bhutan frontier and the Kazirunga in the centre of the valley on the south bank of the Brahmaputra. Both areas were originally selected for the Great One-horned Rhinoceros (*R. unicornis*) they contained, and a very fine stock of these animals was raised as the result of the protection afforded. Kazirunga, the more low-lying, is particularly suited for buffalo too, the Monas for bison along the Bhutan boundary.

The rhinoceros, our most important animal from the natural history point of view, is a difficult species to preserve even though its destruction is forbidden by law, because all parts of its body may be eaten even by Brahmins and because its horn is reputed throughout the East to possess aphrodisiac properties, while it lays itself open to easy slaughter by its habit of depositing dung on the same heap day after day. The demand for rhinoceros' horns has always been considerable in India, but of recent years China has also been in the market, consequent on the practical extermination of *R. sondaicus* in Lower Burma, Tenasserim, etc., with the result that a horn is now worth just about half its weight in gold. The prospect of a lucrative business led to an organization being formed for passing on rhinoceros' horns and elephant tusks to Calcutta, and the disturbed political conditions provided the virile Boro tribes (Meches and Kacharies) living near the Monas with the opportunity to take up poaching on a large scale.

The operations of the financiers in the background were checked for the time being; the advent of the Assam Rifles restored order;

additional game-watchers were engaged, and an Assistant Conservator was placed in charge of the Sanctuary to carry on the good work, but in view of what has happened in Burma, despite the best efforts of the authorities there, one cannot be confident that the fight we are putting up will not prove in the end to be a losing one if we merely continue on present lines.

A fundamental obstacle to success lies in the difficulty of identifying poachers unless these are actually caught in *flagrante delicto*, and this must always be a rare occurrence when members of a gang have only to separate and run a few yards into the high grass to evade capture.

Both Sanctuaries are at present inaccessible for want of roads and camping huts except to those who can travel light, such as poachers and game-watchers, and to those who can command the use of elephants, such as Forest Officers and a few planters. It was pointed out some years ago that this being so it would be quite possible, without the outside world being any the wiser at the time, for a dishonest subordinate in immediate charge of a Sanctuary to sell all the game while his Forest Officer, absorbed in other duties, was earning credit for the good work he might be doing elsewhere in the division. The loss would obviously be irreparable, and it was suggested that in these circumstances the western and eastern portions of the Monas Sanctuary, which with adjacent Reserves contains an effective area of about 150 sq. miles, should be opened to shooting under very strict supervision, the bag being limited (wounded to count as killed) and very high fees being charged, while the central part was preserved inviolate for the benefit of those interested in studying or photographing wild animals. The Sanctuary is only 10 miles north of the Amingaon branch of the Eastern Bengal Railway, and the interior could very cheaply be made accessible to lorries and cars running up from the station by constructing a few cold weather roads in flat country; the whole journey from Calcutta would take less than twenty-four hours of comfortable travel.

It was felt that in this way a healthy publicity would be ensured, because anyone coming up to shoot or to photograph would have plenty to say if game was found to be very scarce, also that the Sanctuary would be put on a paying basis, for whether the East actually is or is not less materialistic than the West, it is certain that no Province will be able to afford idealistic Finance Ministers, and finally it was felt that overstocking of the ground could in this way be guarded against.

It is permissible to believe that the Sanctuaries might have some chance of survival if they could be made more or less self-supporting, but precious little otherwise, and the question is one on which, we may feel sure, advice from the Society from the depths of its experience would not be resented. The Assam of the future may very well be proud to think it is taking its stand by the side of other civilized countries in saving its fauna from extinction, but it is going to be a poor Province, at any rate to start with, and if only some revenue could be expected from shooting permits and from the sale of captured specimens to Zoological Gardens, there would clearly be less initial hostility for the good cause to face.

Anything in the nature of a Public Park on the lines of the Kruger National Park would be out of the question unless it was under Imperial control because if the Assamese tax payer ever wants anything of this sort, he will certainly demand that all predatory and dangerous animals be removed before he disports himself in it.

### *Balipara Political Area.*

Apart from the two Sanctuaries mentioned previously, the rhino have one remaining refuge, namely, the Balipara Political Area. Here some very valuable protection has been afforded to this animal in one area by a planter who is an enthusiastic game preserver. Efforts should be made now to enlist the sympathies of the authorities who will have to guard the welfare of frontier tracts for many years to come, and who will doubtless welcome more extended interest being taken in a matter that has now become of world-wide importance to naturalists.

The specially favourable factors in the case of the Balipara Political Area are:—

(1) It will permanently remain outside the influence of the new reforms.

(2) It consists very largely of Forest Reserves, which contain a number of rhino haunts, Gohpur, the Diputa, Gabharu, and Sonairupa rivers and, if buffalo-grazing was stopped, the Bor Dikrai.

(3) The tract is under a Political Officer who is provided with summary powers and the means of upholding them.

The possibilities here are obviously great, and the opportunity of achieving something permanent seems too good to be neglected.

### *Type of Game.*

A few particulars regarding some of the species found in Assam are added by way of conclusion:—

*Elephant* (*E. maximus*). The country available for wild elephants has been much reduced as the result of land being taken up for settlement while the increasing unwillingness on the part of villagers to tolerate damage to crops will prevent any slowing down of catching operations, but elephants will continue to be numerous in several districts for a long time yet. Over 400 were caught three seasons ago by the Forest Department in one area alone, but this was probably the last big Kheddah that the Province will ever see. Casualties used to be heavy during training, but Government took the matter up and has demonstrated that these are unnecessary and that much higher profits follow the adoption of more humane methods. The rumour that a dumpy breed of wild elephant lived on the central ridge of the Garo Hills has been found to be false as regards the existence of herds composed of such animals, but the inquiry showed that exceptionally shortlegged specimens are to be met with; it is a matter that some local officer might find interesting to pursue further.

One result of the decrease in the number of wild elephants is the inconvenience experienced in getting about Reserves where elephants have become scarce, as their paths are no longer kept open by the passage of herds. The Province of Bihar has always been the best customer for elephants but as it will be out of this market for many years to come, it is not improbable that elephant control measures will have to be undertaken as in Burma.

The Great One-horned Rhinoceros (*R. unicornis*) has been dealt with already at sufficient length.

The Smaller One-horned Rhinoceros (*R. sondaicus*).—It is on record that Messrs. Rowland Ward identified the head and shield from a rhino shot by a Forest Officer in the Bengal Dooars as belonging to this species, and it would be strange if it did not also occur in the contiguous Goalpara Reserves and Monas Sanctuary. Pairs of smaller, less truculent, and definitely less armoured rhino can be put up in the Sanctuary and these, if not cases of *R. unicornis* pairing while still far from mature, must be specimens of *R. sondaicus*.

Investigation into this is most desirable, and perhaps the Society could arrange for it being carried out in the course of time. The Kacharies recognize three varieties of rhino, and though their classification is not made on scientific lines, it does not follow therefrom that it is all moonshine.

The Sumatran Two-horned Rhinoceros (*R. sumatrensis*).—Formerly common in the Luhsai and Manipur Hills and occasionally found in North Cachar, but by now almost hunted to the vanishing point by Lushais and Kukis. The opening up by forest villagers of several big patches of marshy land in the Forest Reserves of South Cachar seriously reduced the number of suitable haunts available for this species. Most of the remaining patches, however, will have to be kept closed to cultivation in order to preserve feeding-grounds for the timber-dragging elephants, and some special steps have already been taken to try and look after the few rhino still left alive in this difficult country where little control can be exercised over shikaries. The record flood of July, 1929, drove the rhino up into the hills and very few have been allowed by the Lushais to return.

The Indian Buffalo (*Bubalus bubalis*).—The great-horned variety, *macroceros*, formerly existed on the Monas, but had been practically shot out before the formation of the Sanctuary. The writer was fortunate enough to meet the last survivor, a well-known cow, at least a hand higher than the ordinary sized bull with which she was consorting. The Vernay-Fanthorpe Expedition searched for this cow unsuccessfully, and she was never seen afterwards. The best heads come from Central Assam, so there should be some very fine specimens in the adjacent Kazirunga Sanctuary.

The Assamese utilize the services of solitary wild bulls for their domestic cow-buffaloes, a magnificent breed which is bound to deteriorate now that wild bulls are getting scarce, and in the absence of anyone interested in scientific breeding. Buffaloes with wild blood in them live longer and are finer draught animals than those of inferior strains, and the cows give more milk. Their disadvantages are sensitiveness to sun and bad tempers.

The wild and tame buffalo of the marshes live largely on the wild rice-plant and are accustomed to warm wallows, but the wild buffalo of the upper reaches of the Monas feed on highland grasses and bathe daily in the cold river water which would be fatal to the marsh-dwellers. These upland buffalo are possibly a little higher on the leg.

The wild buffalo in the Diyung Valley of the North Cachar Hills are very distinctive with short legs, great barrels, and straight horns without the backward sweep before coming forward again to form the tips. Many Mikir Buffaloes ran wild about 1897, when their owners had died from Kala-azar, but probably the whole stock had tame ancestors as they closely resemble the so-called 'Manipuri Buffalo' which is brought through Manipur from Burma for sale in the Surma Valley.

The Gaur (*Bibos gaurus*).—Just as the buffalo is having a bad time from everyone wanting to grow rice where it wants to live, so the gaur, though safe from the Hindu and living in hills in which shifting cultivation alone is practised, is suffering from the hillmen, who sit up at night over saltlicks and plug everything that comes along; consequently it is already only a tradition in many hills where formerly numerous. Solitary bison bulls breed with the tame gayals or Mithun (*Bibos frontalis*) in the neighbourhood of the Kutcha Naga villages in North Cachar and consequently the tame animals there are coloured the same as the wild ones, but wherever there has not been any infiltration of wild blood for a long time, as in the Abor Hills and parts of Manipur, albinism in varying degree is common, many Mithun being pied like Friesian cattle.

A Kachari gamekeeper, a bold man not given to romancing but also not infallible, declares that he has encountered and is scared of a larger, redder, fiercer mithun to be found at a few places on the Bhutan border, and the same story is told by the Mikirs in the hills on the Kamrup-Nowgong border away on the south bank. This may have something to do with the alleged large 'moh-mithun' and smaller 'Goru-mithun' of the Assamese Plains. The writer before he had heard about the supposed red variety was once eating his breakfast at dawn on a cliff while camp was being struck, while two bull mithun were mooning about in the rocky river bed below. One, as ascertained by glasses, was young but was as big as the old black fellow; the young one was very markedly red even to the naked eye at a range of 500 or 600 yds., and was either a freak in colour or else belonged to a separate variety, associating perhaps with one of the black kind after having been driven out from its own herd. Circumstances always arose to prevent the fruition of the expeditions planned to investigate the matter but as there is some possibility, if not probability, about the story being true, it is to be hoped that somebody will one day be able to find time to go and camp in those parts and inquire.

Swamp Deer, Barasingha (*Rucervus duvaucelii*).—This beautiful deer will soon only be found within protected areas, as it is so easily shot by poachers using elephants in their business. The horns in Assam are poor.

Sambar, Hog Deer, and Barking Deer (*Rusa unicolor, Hyelaphus porcinus, Muntiacus muntjak*) are all common in Assam. The sambar is the big-bodied, solitary Malayan type with small antlers; both sexes display that extraordinary raw patch on the lower side of the neck, for which no reasonable explanation has been suggested. Specimens reared in captivity do not develop it.

The Indian Wild Boar (*Sus cristatus*) is abundant and still interbreeds with village pigs. These without occasional crossing with the wild stock often develop white patches, like the tame mithun, either in the form of blazes or white socks.

Pigmy Hog (*Porcula salvania*).—Not uncommon in places but seldom seems to be shot.

Wild Dog (*Cuon rutilans*?).—All villagers and many Europeans in Assam assert that there are two kinds of wild dog, a larger species hunting in packs. The writer had only come across the latter once and so long ago that he was beginning to think he must have been mistaken until an opportunity occurred a couple of years ago on the Barak in Manipur to observe this small variety at close range. A sambar hind was standing in the water staring into a little hidden bay and occasionally stamping her foot. While the boat was paddled quietly up the pool a wild dog appeared on the bank, apparently to act as sentry, and not noticing the boat at once it proceeded to perch itself on a rock. It was not only considerably smaller and more foxy looking about the ears and muzzle than the familiar wild dog, but in place of the rather short thick tail it had a regular brush, which it curled gracefully forward just as a fox would do when sitting down. There were about a dozen of these dogs round the corner worrying the skin of a sambar fawn, which had been devoured before the very eyes of the mother standing less than 30 ft. away. This was being discussed one day at a station on the hill-section of the Assam-Bengal Railway called Harangajao when a Gurkhali herdsman chipped in to say that both varieties of wild dog killed cattle of his during the Rains: he distinguished them as Hindu and Mussulman dogs. A good reward was promised if he would bring in skins and skulls of both kinds, but without any result.

The most interesting bird that Assam can boast of is the Pink-headed Duck (*Rhodonessa caryophyllacea* Latham), which is possibly extinct elsewhere. There were a good few at one time in some lagoons known to the writer and a few friends, but their number was unfortunately thinned out by a baboo doctor posted in the locality in connection with Kala-azar duty, who was the possessor of a gun and, if he liked eating these duck, of a most indiscriminating palate. The jungle which protects the lagoons is gradually being cleared away and with it the last of the duck is likely to disappear.

## No. 4. *THE UNITED PROVINCES.*

BY

F. W. CHAMPION, I.F.S.

(*Deputy Conservator of Forests, United Provinces*).

One among the numerous striking results of the Great War has been an awakening all over the world to the fact that wild animals are tending to become less and less in numbers in many countries, and often species that were common a few decades ago are being, or actually have been, entirely exterminated. Most of us who went through the War saw far too much of killing ever to want to see any more, and the natural reaction has been that a new spirit of sympathy with wild creatures has become firmly established in many countries. Wild life protection societies are springing up here and there, particularly in America and England, and the Society for the Protection of the Fauna of the Empire is doing great work in trying to preserve the wonderful fauna of the British Empire from further wanton destruction. An enthusiastic branch of this Society has been started in India and a very good work is being done, but unfortunately it is not receiving so much support from Indians as could be desired. Indians, many of whom are prohibited by their religion from taking life, should be the very first to support such a Society and a number are already whole-heartedly doing so, but real mass support has yet to be received. This I believe to be very largely due to lack of knowledge of the aims and objects of such a society, and insufficient propaganda, and I am confident that much greater support will be received in future as a result of the great efforts now being made by the Bombay Natural History Society and the various local branches of the Society for the Preservation of the Fauna of the Empire, which all who have the slightest interest in wild animals should join without a day's further delay. After all, once a species of wild animal has been exterminated, no money, no Society, no human agency can bring that species back to the world, and delay in helping those who are doing their best to save species already threatened with extermination may mean that help, tardily given, is given too late.

### *Position of Wild life.*

The present position in the United Provinces is, perhaps, not quite so bad as in some other parts of India, owing to the presence of a very sympathetic government, an influential Forest Department, and great land-holders, all of whom have always remembered that, within limits, wild creatures have just as much right to exist as the human race. The position inside reserved forests and in certain large estates, which is fairly satisfactory, will be discussed later in this article, but first the present state of affairs in the ordinary districts will be considered. It is the conditions in these ordinary districts, composing 80 per cent or more of the whole Province, which are causing so much worry to those who are interested in wild life. Frankly the position is appalling. The vast increase in gun-licenses which has taken place within recent years, combined with the greatly improved means of transport, has caused a drain on the wild life of the districts such as can end only in the almost complete destruction of any kind of wild creature considered to be worth powder and shot. Laws do exist imposing close seasons, but these laws often are not, and cannot be, observed in present-day conditions. Deputy Commissioners and Superintendents of Police in some cases do their utmost, but they are so over-worked nowadays with political and economical troubles that, however keen they may be, they literally have neither the time nor the energy to try to enforce unpopular laws, which, by comparison with present-day troubles, possibly do not seem very important. Further the responsible officers in a district are very few in number and it is quite impossible for them to stop bribery among their often low-paid subordinates. A rupee or two or a piece of meat is quite sufficient temptation to an underpaid *chowkidar* not to report an offence under a Wild Animals' Protection Act, particularly as it is often extremely difficult to prove such an offence, and, even if proved, a subordinate magistrate will generally let off the offender with a purely nominal fine. It therefore seems that, in the present state of the country, any Act enforcing close seasons outside Reserved Forests, however well it may be conceived, is worth little more than the paper on which it is written. In actual fact special efforts are now being made in Hamirpur and Meerut districts to protect *sambar* and *chital*, but it is not known to the writer how far such efforts are proving successful. Animals like black-buck and *chital* and game-birds, both in the plains and particularly the hills, are literally being wiped out at an increasingly rapid rate and one wonders if there will be anything left except monkeys and jackals after another two or three decades. There is one bright spot, however, and that is that non-game birds at least are not harried to the same extent as in England because the egg-collector is scarce, and the average Indian boy, unlike his English confrere, does not amuse himself by collecting vast numbers of birds' eggs, only to throw them away in most cases as soon as the boy begins to grow up. Taken as a whole there is no doubt whatever but that the position in these plains districts of the United Provinces is just about as bad as it could be, but one must always remember that these areas are very densely populated and that really there is not very much room for any considerable numbers of the larger game animals, which must tend to interfere with the cultivator and his crops. In any case leopards are found in many places, since they are prolific breeders and very difficult to keep in check, and, even if more adequate protection were given to the game animals in cultivated districts, it is probable that their numbers would still be kept down by a corresponding increase in the numbers of leopards.

Sufficient has now been written to show that the position in the cultivated districts is very unsatisfactory, but that increasing population in already heavily populated areas, combined with the present political and economic distress, makes it very difficult to make practical suggestions for improving matters. What can be done is for large land-holders in sparsely populated districts to preserve restricted areas really efficiently and noble examples of what a great help to the wild life of a country such measures can prove to be is to be found in the great swamp-deer preserves of Oudh, notably those of the Mahrani Saheba of Singahi and of Captain Lionel Hearsey. The former of these has been under careful protection for many years and an area of perhaps 20 square miles now contains several thousand head of these magnificent deer. A few are shot annually, but the number destroyed is almost certainly less than the natural increase, and these public-spirited benefactors can justifiably feel that, so long as they maintain their present standard of efficient preservation, there is no fear of the swamp-deer following the already long list of fine animals which have been exterminated from the United Provinces.

### *Reserved Forests.*

Now the position of wild animals in the Reserved Forests, of which the writer, being a Forest Officer, has perhaps a specialised knowledge, will be considered. Firstly the writer would state most emphatically that United Provinces forest officers as a class are, and always have been, extremely sympathetic towards wild animals. Few are really heavy killers and quite a number do not shoot animals at all, beyond their requirements for food for themselves or their camp followers. An odd individual here and there, both in the present day and in the past, has possibly let his sporting instincts drive him into becoming a really heavy killer, but the amount of slaughter done by the average forest officer in these Provinces is conspicuously small. It sometimes happens that disgruntled sportsmen state that Forest Officers are selfish or destroy more animals than all other classes put together; but these statements are most emphatically untrue and generally have an inner history, which reveals the accuser as having some personal grudge against an individual Forest Officer, which leads him to make general insinuations which are totally unfounded. None could be keener on the preservation of wild life than the present writer, and, if he thought that his brother officers were indifferent to the preservation of wild animals, he would not hesitate to say so. The writer believes that it would be a great mistake to remove the wild animals inside Reserved Forests from the protection of the Forest Department and place them in charge of a separate Game Department. The present system is working very well and such action would be regarded as a slur on Forest Officers and would alienate the all-important sympathy of the powerful Forest Department.

The United Provinces reserved forests are not very extensive and they are all under the personal supervision of divisional forest officers. Poaching does occur to a limited extent, particularly during the monsoon when the forests have to be deserted owing to their unhealthiness, and from motor cars, but such poaching is not very extensive and every effort is made to keep it in check. Elaborate rules, which are constantly being amended, do exist for the issue for shooting licenses, for the enforcement of close seasons, and for helping any species which is tending to become scarce. These rules may not be perfect—no rules ever are—but at least their object is to provide shooting for all who apply in the right way, and at the same time to preserve the wild animals in perpetuity without letting them increase to such an extent as to become a nuisance to forest management or to surrounding villagers. Species that, for any particular reason, need help are entirely protected, examples being wild elephants for many years and Sambar in Lansdowne division since an attack of rinderpest in 1927; and senior forest officers are always ready to listen sympathetically to applications for protecting particular animals in particular tracts. Even tigers now have a close season and are not allowed to be shot by artificial light. Some may argue that it is a wrong policy to protect tigers, but at least such protection shows that forest officers consider that even tigers have the right to live in their own jungles.

On the other hand some wild animals, such as deer, do seriously interfere with the management and revenue of valuable forests, and the forest officer cannot allow deer to increase to an excessive extent. In some cases, particularly where the balance of nature has been upset by the excessive destruction of carnivora, deer have become a positive pest, and it has proved necessary to reduce their numbers. Or again, the proportion of hinds may have become excessive, with consequent deterioration in the size of the stags, so that some of the hinds have had to be shot off; but such destruction is stopped as soon as the position becomes normal once again. It is true that individual forest officers, keen silviculturists who have found all their efforts at improving the forests ruined, have occasionally advocated the total destruction of deer; but it is not the general opinion that such drastic measures are required and interesting experiments are now in progress by which considerable areas, in which plantations or efforts at obtaining natural regeneration of valuable trees are in progress, are entirely closed with game-proof fencing, which keeps out the deer. Such fences are somewhat expensive in initial cost, but they can be moved from place to place as required and are probably the best solution for managing forests both in the interest of the forester and also of the indigenous wild life.

It is sometimes stated that, even in the reserved forests, wild animals are much scarcer than they used to be. The writer cannot speak for 30 or 40 years ago since the old records are not clear and he was not in India at that time; but, even if the head of game had diminished, it is possible that the numbers were excessive in the past or that the memories of those who claim that animals are disappearing are a little at fault. After all, most of us tend to think of the 'good old times', although it is possible that those times were not quite so good as they now appear in perspective. An effort has been made to collect figures of animals shot in the past with those shot nowadays for comparison, but records of 30 or 40 years ago do not give the information required. The following are the conclusions that the writer draws from the figures that are available:—

(a) Taken as a whole the head of game shot recently has generally not shown any marked decrease, except in the mountain reserved forests, where control is not so easy.

(b) Tigers appear to have increased and marked decreases seem to have taken place in the numbers of *nilgai*, *kakar*, wild-dog and black-buck. The decreases are partly due to serious floods and rinderpest epidemics, and are probably natural fluctuations which will right themselves in time. Wild-dogs have decreased owing to the large reward paid for their destruction.

(c) The decreases in the number of some animals shot recently are due to the removal of rewards as a measure of economy.

(d) It must always be remembered, however, that the number of animals inside Reserved Forests is probably being artificially swelled by the influx of refugees from the appalling conditions at present prevailing outside. This influx will decrease as animals outside become exterminated. Also modern rifles are so good and shooting with the help of a motor-car is so easy, that probably a greater proportion of the existing animal population is shot annually nowadays than was the case in the past.

(e) The Forest Department watches these lists carefully and takes action whenever such action appears to be required.

(f) The general impression of senior forest-officers is that, although there have been considerable fluctuations in particular areas, the game in the United Provinces Reserved Forests as a whole has not markedly decreased during the last 25 years, except in the high hill forests.

To summarise, the present position of wild animals inside the Reserved Forests of the plains and foot-hills of the United Provinces does not give cause for serious anxiety, except for the ever-increasing use of that arch enemy of the wild animal—the motor car. The numbers of wild animals in the mountain reserved forests appear definitely to be decreasing. The position in some zemindari estates is good and in others poorer; and the position in the ordinary districts is almost hopeless.

### *Some Suggestions.*

The writer would make the following suggestions to help the present state of affairs:—

(a) *Public opinion.*—This is by far the most important of all methods of wild life conservation, and, without it, all efforts to preserve wild creatures will prove abortive. Good work is already being done by propaganda and by lectures, but much more remains to be done. Good illustrated books help greatly and the formation of sanctuaries and national parks, where the general public can see wild animals in their natural state, would all help. Major Corbett as local Secretary of the United Provinces branch of the Preservation of the Fauna of the Empire Society is doing a lot to assist in this work.

(b) *Laws.*—It is much easier in the present state of India to pass a law than to see it enforced, but the writer would greatly like to see laws passed on the following points:—

(1) *Sale of shikar meat, trophies, etc.*—It is of vital importance that a law be passed at an early date totally forbidding the sale of any portion of a wild animal, with certain definite exceptions. Such exceptions would be the dropped horns of deer, and the hides of deer where numbers have to be reduced. Special licences should be issued in such cases and such licences, liable to cancellation at any moment, should be under the personal control of the Divisional Forest Officers, where reserved forests are anywhere near, or under Deputy Commissioners where there are no forest officers. The sale of any *shikar* trophy should be entirely and absolutely prohibited. Such a law, properly enforced, would finish the professional poacher, and would end the nefarious dealings of certain taxidermists who sell *shikar* trophies to those 'sportsmen' who are incapable of bagging anything themselves.

(2) *Limitation of gun licences.*—This is very difficult in the present political state of the country, but at least greater efforts could be made to differentiate between game licences and licences for the protection of the crops, person, property or display. Gun licences for the protection of crops should insist that barrels should be sawn-off short, as such licences are very largely applied for when the real object is poaching.

(3) *Motor cars (and also carts and tongas).*—The shooting of any wild animal from, or within, say, 400 yards of a motor-car, cart or tonga, either by day or by night, should be made an offence liable to prosecution. The writer personally would like to stop motor cars altogether from entering Reserved Forests, or, where this cannot be done, he would like to place check-chowkies at the entrances and exits of such roads, the cost to be covered by a small wheel-tax. Fire-arms would either have to be deposited at such *chowkies* or would be sealed, so that they could not be used while inside the forests. The excuse of requiring fire-arms for protection en route should not be accepted, as pasengers in motor-cars very rarely need protection from wild animals, except possibly from occasional rogue elephants or man-eaters. Luckily recent economies have resulted in the abandoning of some of the motor-roads in the Reserved Forests of the United Provinces. The writer would like to see them all abandoned! The old time *shikari* or Forest Officer managed perfectly well without them, and they tend only too often to make his modern successor slap-dash and lazy.

(4) *Protection of rare stragglers.*—It occasionally happens that a rare animal, such as a rhinoceros, strays into Reserved Forests from Nepal or elsewhere. Such animals should be rigidly protected with a fine of, say, Rs. 2,000, or imprisonment, for their destruction. The excuse that 'If I don't shoot it, someone else will' should never be accepted in such cases. The recent law passed in Bengal for the protection of the rhinoceros, should be extended to the whole of India.

(5) *Rewards.*—The writer considers that Government rewards

for destroying wild animals should be given far more sparingly than in the past. Luckily, recent economies have resulted in a great reduction in the rewards offered, and it is sincerely to be hoped that such reduction will be permanent. Rewards in the past have encouraged poachers and have sometimes caused an upset in the balance of nature where they were misapplied. They are really quite unnecessary except for man-eaters and notoriously destructive creatures such as porcupines.

It has been suggested that details of breeding-seasons of various animals should be appended to this article. Inside Reserved Forests every effort is made to protect wild creatures during their breeding seasons and nothing more can be done. Outside Reserved Forests, as already explained in this article, the position is such that protection can very doubtfully be enforced. Hence such an addition to an article which is already too long seems unnecessary, but the writer can supply a list of breeding seasons, so far as they are known, to anyone who is specially interested in the matter.

Since writing the above I have been reconsidering this question and have read up a certain amount of literature on the subject. On the whole I have little to add to what I wrote before except that I am not so certain as I was that the head of game inside the United Provinces' reserved forests is not decreasing. I was posted to N. Kheri Division in 1921 and I returned there again in 1931. Although still a good place for animals in 1931, I would estimate that there had been at least a 25 per cent decrease in nearly all species during that decade. The reasons for this reduction I would put down to (*a*) Motor-cars making shooting far easier than it used to be, (*b*) the destruction of game in the adjoining areas outside the forests resulting in a smaller influx and greater damage to animals straying outside.

I am now in Bahraich division in Oudh, which has a reputation of being a good game division. I have now been here for 5 months and, so far, I have found game of all kinds to be rather scarce, although I hear that more animals come in from Nepal in the hot weather. The reasons for this apparent decrease are the same as in Kheri, i.e., motor-cars and destruction of animals outside the forests, combined with increased poaching along and near the Nepal border.

I have recently heard from Col. A. E. Wood, I.M.S.—a keen supporter of the Darjeeling Natural History Society—that in his earlier days Lachiwala in Dehra Dun division used to be a 'veritable paradise' for wild animals. I am well acquainted with Lachiwala and I can only say that it is very far from being an animal paradise nowadays. It is more a 'paradise' for motor-picnicers from Dehra Dun City and Cantonment!

On the whole I am afraid that there is a distinct doubt that the game inside the reserved forests—particularly in Oudh, where motors now penetrate to every corner—is so plentiful as it was, although the present position does not give rise to the same anxiety as is the case with other areas not under the control of the Forest Department.

PRINTED AT THE DIOCESAN PRESS, MADRAS—1934. C9399.

# APPEAL

MY studies of the animal remains excavated at Harappa, Punjab, have made it necessary to elucidate the ancestry and determine the various races of Pie dogs of India. For this work it is essential to get together a large series of skulls for comparative study, and I shall be obliged if members of the Society will collect a series of skulls (including the lower jaws) of at least 6 Pie dogs from different localities in India. So far as possible skulls of adult specimens should be collected, and the sex of the individuals noted in each case.

**BAINI PRASHAD,**
*Director,*
Zoological Survey of India,
CALCUTTA.

*January 23, 1934.*

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1934
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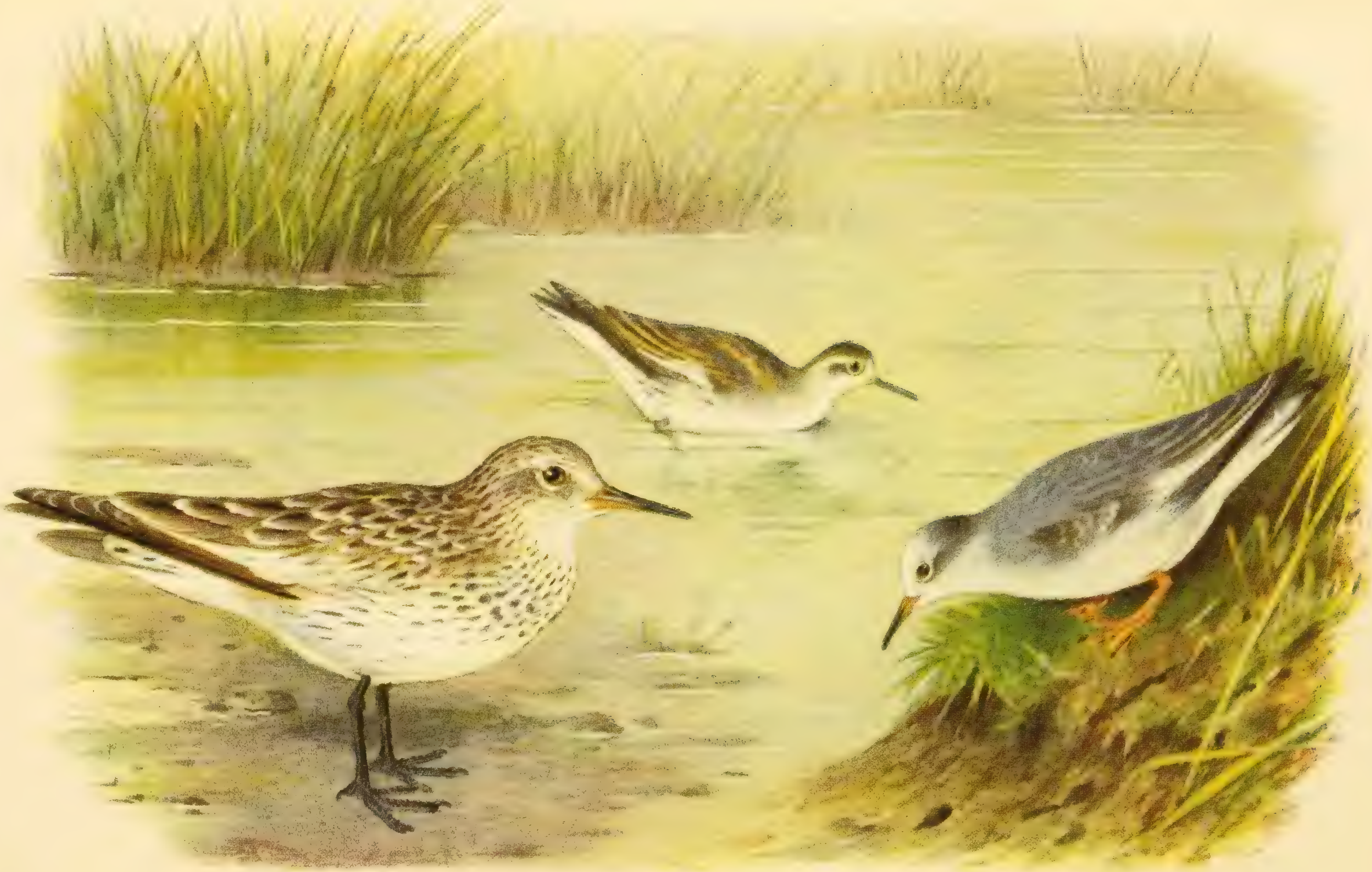

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Eastern Knot. 1/3
Calidris tenuirostris.

Red-necked Phalarope. 1/3
Lobipes lobatus.

Grey Phalarope (winter). 1/3
Phalaropus fulicarius jourdaini.

JOURNAL
OF THE
Bombay Natural History Society.

August, 1934. Vol. XXXVII. No. 2

# THE GAME BIRDS OF THE INDIAN EMPIRE.

BY

E. C. Stuart Baker, c.i.e., f.z.s., f.l.s., m.b.o.u., h.f.a.o.u.

## Vol. V.

## THE WADERS AND OTHER SEMI-SPORTING BIRDS.

## Part XXI.

(*With a coloured plate*).

(*Continued from page 14 of this volume*).

### Genus: Calidris.

*Calidris* Anonymous, Allg. Lit. Zeitung, 1804, No. 168, col. 542. Type by taut. *Tringa calidris* = *Tringa canatus* Linn.

In this genus the bill is long, straight and stout; both mandibles grooved while the long linear nostril is placed near the base, at the bottom of the groove on the upper mandible; the tarsi are rather short and stout and scutellated throughout; posterior toe present; anterior toes not joined together with webs; the wing is long with first primary longest.

One species of the genus occurs in India and the genus itself is almost cosmopolitan.

### Calidris tenuirostris.

*The Eastern Knot.*

*Totanus tenuirostris* Horsf., Trans. Linn. Soc., xiii, p. 192 (1831) (Java).

*Tringa crassirostris.* Blanf. & Oates, iv, p. 277.

*Calidris tenuirostris.*—Stuart Baker, Fauna of B. I., vol. vi, p. 247.

*Vernacular Names.*—None recorded.

*Description.*—*Breeding plumage.*—Whole head black, each feather streaked laterally with white, broader on the hind-neck;

1934
OCT 1

back black, each feather narrowly edged with rufous-white and with a little rufous marking; scapulars with broad chestnut markings on both webs; lower back brown, the feathers edged with grey; upper tail-coverts barred black and white; tail-feathers grey-brown, pale-edged and the lateral also pale-shafted; wing-coverts brown, edged with whitish and with darker centres and shafts; primary coverts and primaries blackish, the latter white-shafted and with paler inner webs; outer secondaries paler and inner secondaries darker again, the former with broader white edges, the latter with rufous-white edges; sides of head, chin, throat and fore-neck white streaked with black; upper breast black with very fine white edges; lower breast and posterior flanks white with blackish spots; centre of abdomen pure white; under tail-coverts white, lightly spotted with black; axillaries white with contour lines of light brown.

*Colours of soft parts.*—Iris dark brown, bill dusky-black; legs and feet greenish-dusky (Armstrong).

*Measurements.*—Wing 165 to 185 mm.; tail 63 to 69 mm.; tarsus 34 to 38 mm.; culmen 39 to 47 mm. It is possible that there are two races of this bird, though it is impossible to separate these until the breeding-haunts are known. Indian birds have the wing from 176 to 185 mm., whilst Burmese and Malayan birds have it only 165 to 175 mm.

*In Winter* the upper parts are pale greyish-brown; each feather with dark shafts, broadening to streaks on the head and neck; longer feathers of the mantle and scapulars with white-edged tips; chin and throat pure white; sides of head and neck, fore-neck, upper breast and flanks white spotted with brown; remainder of lower plumage pure white.

*Distribution.*—In Summer, Central and Eastern Siberia to Japan. In Winter it is found south to India, the Malay Archipelago and east to Australia. In India it has been obtained on the coasts of Sind and Baluchistan, south to the Laccadives on the West coast; near Calcutta and at Madras on the East coast; on the Andamans and the coasts of Burma.

*Nidification.*—Nothing recorded.

*Habits.*—This bird, the breeding haunts of which are not yet definitely known beyond the fact that they are somewhere in Eastern Siberia, is a comparatively rare wanderer in Winter to India and Burma. From there it is found in all the southern countries and some of the islands east to Australia.

In Burma, it was found by Oates in Arakan (Akyab) and by Armstrong near the mouths of the Rangoon river; Wardlaw-Ramsay obtained it in the Andamans; Moore and I myself shot it in Dibrugarh and I had a specimen sent me from Cachar for identification; Jerdon, under the name *canutus*, records it from Madras and Calcutta. In the West it has been found in the Laccadives by Hume and it has been observed in Baluchistan and Sind.

Meinertzhagen records the Western Knot (*Erolia canutus canutus*), a single specimen, from Khushdil in Baluchistan, but I have not seen this specimen.

Very little is recorded about this bird, which is not uncommon on the North-West coasts of India and undoubtedly also visits

Assam and Burma more frequently than has hitherto been assumed to be the case. I only once shot it in Assam but Messrs. Moore and Mundy also shot two and saw others from time to time, though they found, as I did, that the birds were frequently unapproachable and very wild.

In Sind, where Hume said it was common in his time, Ticehurst writes (Ibis 1924, p. 115):—

'I found it to be the least common of all the waders which frequent the tidal creeks, but as I only saw it at very high tides it is quite likely that it was not shifted from its favourite feeding grounds to places where it could come under observation at other times, normal tides leaving vast areas of mud flat uncovered or only just covered. On the wing it looks a big bird and could not be confused with the Common Knot—indeed I usually found it more difficult to distinguish it in the distance from Bar-tailed Godwits, with which it often associates.

'By the end of April males are in nearly full breeding dress, but females by mid-May are not nearly so far forward, and one on the 17th had only just begun heavy moult. The last seen was 5th June.

'Guadar on the Mekran coast is the Western limit of this bird.'

I only saw this bird when it was evidently on the move in the October and Spring migrations. They were feeding with other waders in vast swamps but were restless and constantly on the move, often, when disturbed, at once flying away out of sight to the South. I should expect them to be not so rare in Winter on the alluvial river banks and flats of the Sunderbands.

The bird I shot, a male, had been feeding on tiny white worms and was in very poor condition on October the 12th. The bird shot in Cachar, in the same month, was comparatively fat.

### SUBFAMILY: PHALAROPINAE.

In this family the toes are bordered throughout by a web divided into lobes very much as in the Coots and Grebes. In other respects they are similar to birds of the genus *Erolia* but, unlike them, the female is bigger and more richly coloured than the male, the latter performing the duties of incubation.

The subfamily contains three genera, each consisting of a single species. Two genera and species are found in India during the cold weather.

*Key to Genera.*

A. Bill flat, broader than the tasus and broader than high ... ... ... *Phalaropus.*
B. Bill slender and subcylindrical, anteriorly narrower than the tarsus ... ... *Lobipes.*

### GENUS: PHALAROPUS.

*Phalaropus* Brisson, Orn., i, p. 50, vi, p. 12 (1760).

Type by taut. *Tringa fulicaria* Linn.

Characters those of the subfamily; the wings are long and pointed with the first primary longest; the tail moderate and nearly square; the tarsus scutellated all round; a hind toe present; the bill is short and straight, distinctly flattened or depressed and rather stout; the nostril is placed near the base of the bill in a well-defined groove.

### PHALAROPUS FULICARIUS.

*Tringa fulicarius* Linn., Syst. Nat., 10th ed., i, p. 148 (1758).

Type-locality. Hudson Bay, North America.

This form is said to differ from *P. f. jourdaini* in being darker and less rufous when in full breeding dress.

### PHALAROPUS FULICARIUS JOURDAINI.

*The Grey Phalarope.*

*Phalaropus fulicarius jourdaini* Iredale, Bull. B.O.C., lxii, p. 8 (1922) (Spitzbergen).

*Phalaropus fulicarius.* Blanf. & Oates, iv, p. 282.

*Phalaropus fulicarius jourdaini.* Stuart Baker, Fauna of B.I., Birds, vol. vi, p. 248.

*Vernacular Names.*—None recorded.

*Description.—Female in breeding plumage.*—Face blackish-grey; crown and nape black; sides of head white; centre of hind-neck grey, sides deep rufous; mantle velvet-black, the feathers broadly edged with pale rufous or creamy-buff, forming two fairly definite lines down the scapulars; lower back and rump grey in the centre, white laterally; upper tail-coverts rufous, marked with black and white on a few of the central feathers; tail-feathers grey, almost black at the tip, edged with whitish and the two penultimate pairs marked with rufous; wing-coverts grey edged with white, the tips of the greater forming a white wing-bar; primary coverts and primaries dark brown, the latter with white shafts and a few of the later feathers with white edges to the base of the outer webs; outer secondaries brown narrowly edged with white, the central almost all white and the innermost long ones like the mantle; chin grey-black; axillaries and under wing-coverts white; remainder of lower plumage deep rufous, generally with a plum tinge from lower breast to vent.

*Colours of soft parts.*—Iris dark brown; bill dark horny-brown, orange at the base; legs and feet dull brown or fleshy-brown.

*Measurements.*—Wing 129 to 142 mm.; tail 56 to 65 mm.; tarsus 20 to 23 mm.; culmen about 20 to 24 mm.

*Male in breeding plumage.*—Similar to the female but the head duller, the feathers of the crown with rufous edges; the patch of white on the sides of the head smaller and mixed with rufous and white; lower surface often mixed with white. The male is a little smaller than the female. Wing 126 to 135 mm. (Witherby).

*Male and female in non-breeding plumage.*—Forehead, supercilium, sides of head and neck and whole lower plumage white; hinder crown and nape blackish-brown or brown, running in a line down the hind-neck to the extreme upper back; mantle grey with very fine white edges to the feathers and darker shafts; tail and wings as in breeding plumage.

*Young birds* are like the male in Summer but have white foreheads and duller crowns; the chin to breast is rufous-buff fading to white or buffy-white on the remainder of the lower parts.

*Nestling in down.*—Line from the forehead and crown black, centre of nape dull black; forehead buff, lateral coronal lines pale yellowish-buff; upper parts cinnamon-buff mixed with black and whitish; dorsal line and lines on flanks black; a narrow black eye-streak; chin, throat and upper breast yellowish-white, remainder of under surface greyish-white.

*Distribution.*—Breeds in the Arctic regions from Iceland and Spitzbergen to Eastern Siberia, its place being taken in the American Arctic by the typical form. In Winter it migrates to the Mediterranean countries, Northern Africa and has once occurred in India, Blyth having obtained a single specimen in the Calcutta bazaar.

*Nidification.*—Jourdain gives the following notes on some of its breeding places (Ibis, 1922, p. 171) in his account of the birds of Spitzbergen. 'Koenig met with several pairs on the North coast of Bear Island, evidently breeding, on 13-14 July, 1907. In Spitzbergen it occurs locally on many points on the West coast and in Ice Fjord. On the North coast we found it breeding on the Islands in Liefde Bay, as well as on the mainland, in the neighbourhood of marshy pools. Nests were also met with by us on the Edinbergh Isles, the Anser Islands, and the tundra near Cape Bokeman in Ice Fjord. It has also been found on the East side, and breeds on King Ludwig Island (Koenig) and King Charles Land.'

Its nests and eggs are very similar to those of the Red-necked Phalarope but the colonies are often much bigger and the nests are sometimes much closer together. The birds breed both in swampy ground, in actual marsh land and in comparatively dry stretches of short grass, making a nest which consists merely of the growing grass matted down and twisted together to form a pad among the roots of the grass. Rarely they have been known to nest on shingle or open land and here the nest is more substantial, consisting of a deep pad of soft grass in a hollow among the stones and sheltered by tufts of grass or an overhanging stone or boulder. When in deep swamps, tussocks of harder mud and grass are selected and the nest built in among the roots of the latter. The birds are specially fond of islands for breeding purposes but many colonies breed on the mainland, sometimes on the coast and at other times some way inland on the open tundra.

The breeding season, as might be expected of birds so far north, is late. In Iceland early June is the principal time for laying but the bird is rare and very local; in Spitzbergen laying does not start until the end of June or early July, while in the Siberian islands July seems to be the month for eggs.

The full clutch of eggs is probably always four, though it is said that three only are sometimes incubated. These small clutches may, however, be due to accidents or to their being second broods. In appearance the eggs are very like those of the much better known Red-necked Phalarope but average larger and, as a whole, are more boldly blotched with larger markings. Many eggs, however, are quite indistinguishable from those of the Red-necked bird. The ground-colour varies from pale stone, or yellowish stone to a warm buff, or brownish buff, blotched or speckled with blackish brown or chocolate brown with sparse subsidiary markings of grey or pale plum colour.

In shape the eggs are the usual pyriform or broad pegtop typical of the *Limicolae;* the texture is close and hard and in some eggs there is a fair gloss.

Jourdain gives the following measurements of 155 eggs. Average 30.4 × 21.8 mm.; maxima *33.8* × 21.2 and 30.5 × *24.5* mm.; minima *27.5* × 20.6 and 28.5 × *20.5* mm.

In both the Phalaropes the female is the dominant partner in domestic affairs. She does make, or at least help to make, the nest and she lays the eggs but, this done, she leaves all the incubation to the male as well as the greater part of feeding and looking after the chicks when hatched.

*Habits.*—This little bird has only once been found in India. It is not one of the birds which may have been overlooked as its conspicuous grey colour in Winter singles it out from all other waders of like size. If found again it will probably be seen singly rather than in company with other small waders as it is a little bird which seems to keep much to its own kind. In its confiding ways and dainty little motions it is a most charming bird to watch. When the swamp is shallow it may be often seen picking its way about in the grass, feeding as it goes, but it prefers swimming and, as a rule, spends much of its time in the deeper water of pools and open spaces in swamps and marshes. Its food is mainly insectivorous and I have seen it feeding on small 'water spiders' and other surface insects, while it also eats tiny crustacea and mollusca, flies, mosquitoes, etc. It is also said to feed on algae and on shoots and seeds of various water plants. Its actions are sometimes curiously deliberate yet at other times it dashes hither and thither with extraordinary rapidity after small flying insects.

It is extremely tame and allows one to watch it within a very few feet.

Its flight is very much like that of the Stint but less sustained and I have never seen its nuptial flight. Its alarm note has been described by Miss Haviland as 'drrrt-drrrt' but when in flocks the birds keep up a constant twitter, soft and rather low.

### GENUS: LOBIPES.

*Lobipes* Cuvier, Regne Anim., i, p. 495, '1817' = 1816.

Type by mon. *Tringa lobata* Linn.

This genus differs principally from *Phalaropus* in having a much more slender bill, no broader than high and almost cylindrical.

### LOBIPES LOBATUS.

#### *The Red-necked Phalarope.*

*Tringa tobata* ('t' error of type, corrected, p. 824) Linn., Syst. Nat., 10th ed., i, p. 148 (1758) (Hudson Bay, N. America).

*Phalaropus hyperboreus.* Blanf. & Oates, iv, p. 281.

*Lobipes lobatus.* Stuart Baker, Fauna of B.I., 2nd ed., vol. vi, p. 249.

*Vernacular Names.*—None recorded.

*Description.—Female in breeding plumage.*—Upper plumage dark grey-brown, the scapulars, innermost secondaries and tail darker, each feather edged outwardly with rufous, those on the secondaries and back sometimes obsolete; sides of the rump and lateral tail-coverts whitish; central tail-feathers blackish, the lateral rather paler brown edged with white; wing-coverts dark bluish-grey; the greater broadly edged with white, forming a wing-band; primary coverts and primaries blackish, the latter with white shafts; outer secondaries blackish edged with white; chin, throat and lower sides of head white; sides of neck rich rufous, extending in a band round the fore-neck; sides of breast, sometimes meeting below the chestnut band, grey; flanks, axillaries and under wing-coverts mottled white and grey; remainder of lower plumage white.

*Colours of soft parts.*—Iris deep brown; bill dark horny-brown to black; legs and feet pale plumbeous or lavender-blue.

*Measurements.*—Wing, ♂ 105 to 111 mm.; ♀ 110 to 118 mm.; tail 42 to 47 mm.; tarsus about 19 to 21 mm.; culmen 20 to 24.5 mm.

*Male* differs from the female in having the chestnut of the sides of the neck divided by dark grey on the fore-neck.

*In Winter* the upper plumage is grey, the feathers of the mantle edged with white; back, rump and upper tail-coverts blackish-grey; wings dark brown, the white wing-bar very conspicuous; forehead, fore-crown, face and sides of the head white; posterior crown blackish-brown; a patch round the eye, running down the ear-coverts, blackish; sides of breast grey; remaining lower parts white.

*Young birds* have the upper plumage black or nearly so, the feathers of the mantle narrowly edged with warm or pale buff; crown dark brown, extending in a line down the back of the neck; a dark brown line round the lower part of the eye extending over the ear-coverts; sides of head and neck, chin, throat and lower plumage white, the sides of the breast brown or grey-brown.

*Nestling in down.*—Similar to that of the Grey Phalarope but more richly rufous and without the black line from the forehead to the crown.

*Young birds* moult direct from the juvenile plumage into the breeding plumage and do not assume an intervening Winter dress but, on the other hand, a good many birds appear to breed in a semi-mature dress, getting a partially red neck and grey breast but retaining the rest of the juvenile plumage.

*Distribution.*—Breeding circumpolar. In Europe, south to the Orkneys, South Norway, Sweden, Finland, Russia, east to Commander Island and throughout Northern America from Alaska to the Yukon. In Winter it migrates south to North Africa and in Asia to India, Malaya, China and Japan.

*Nidification.*—The Red-necked Phalarope breeds in Arctic and sub-Arctic regions round the world. It is very common in Iceland and breeds as far south as the Shetlands and the Orkneys. In the far North it has comparatively recently been found to breed in Spitzbergen, while I found it breeding commonly in the extreme north of Lapland on the marshes and tundras opposite that country. It seems to be especially fond of islands for breeding purposes and I have seen three or four pairs on tiny islands, hardly more than a small collection of rocks with a few yards of coarse withered grass. It sometimes collects in great numbers in favourite breeding places. Great Heno, an island in the Arctic Ocean, perhaps 3 kilometres long by rather less in width, possesses the usual marshes existing everywhere in the North, and some half dozen shallow lakes or pools surrounded by grass swamp. On this island some 40 or 50 pairs of these birds must breed annually and it is difficult to find a more pleasant way of spending a long Arctic day than one among these most charming little waders. One may not find many nests as they are not too easy to find until one gets to know the tiny owners and their habits, but hardly a minute passes without some little action of interest to note. I have sat on a tussock and had two or three pairs wandering about within a few yards of me and often within a few inches showing the utmost unconcern until finally the little cock thinks it time to settle on the nest and show where it is. Once down he remains down until one almost, or quite, touches him. Often I have not had the heart to disturb him and as one leaves he looks up at one with a quaint little side-long glance as much as to say 'thank you'. Once when standing in this little marsh a Phalarope passed actually between my legs as he darted at some insect on the grass, after which he proceeded to preen his plumage, almost sitting on one of my feet. After about ten minutes at his toilet he dived into a tuft of grass and when I pulled this apart I found him snugly seated on his nest. Touching him with my finger he slipped off but, instead of flying away, stood alongside me peering into the nest and when I stepped back he at once sat down again upon the single egg which had been laid. As a rule when disturbed on the nest the cock-bird flies off, though he often returns as soon as he can, even if the finder remains very close to it. In the Shetlands, where the birds are much disturbed, they are not quite so tame but, even there, I have had the male swim about within a yard or two of me as I examined his nest.

The nests vary a good deal, some being quite well-made little cups of grass and others no more than a mat made by some of the grass being beaten down. On the Fisher Peninsula, where the Phalaropes breed within 50 and 100 yards of the small fishing village, I found two nests which were good examples of the best and worst. One was made just at the edge of a small reedy pool but on dry ground covered with grass only a few inches high and much Reindeer moss. In this latter, the birds had fashioned out a neat little cup, perhaps three inches deep, and then lined it warmly and neatly with the finest shreds of grass, making a bed fully half an inch thick, on which reposed the four eggs. Some twenty yards from this, in the longer grass in a swamp, where the mud and water reached my thighs, was another nest and anything more fragile it would be difficult to conceive. There was no tuft of grass but the stems grew close together out of the water and in the centre of a little patch, where the grass grew thicker than elsewhere, the stems and blades had been bent down to form a cradle resting on the water. Possibly a dozen or so stems had been added to the growing pieces but the whole affair was so flimsy that when the eggs were removed I could push my finger through it without using any force. Often the nest is placed on a tussock in a swamp which is covered with coarse or fine grass and then a few bits of grass or moss in a hollow among the roots is all that is considered necessary by the bird.

In the more southern area the breeding season commences in May but in the more northern not until the middle or end of June. Much, however, depends on the season. In the bitter cold of 1931 I found the Phalaropes in Northern Lapland just starting to breed on the 27th June, no eggs having then been laid. In 1933, a year of almost sub-tropical warmth, I found eggs chipping on the 12th June a hundred miles further North. In normal years fresh eggs may be taken any time from the middle of June to the middle of July. In any one colony the birds seem to breed at the same time. Thus in one colony, one year on the 20th June, all the clutches were complete and varied from quite fresh to about five days set. In another colony six miles away, not one bird had begun to lay.

The eggs are invariably four in number and sets of three are abnormal.

Most eggs have a buff-brown varying from pale dull buff to a warm clear brown. Other eggs have an ochre or sandy yellow ground and very rarely there is a faint tinge of green. The markings consist of blotches and specks of brown, sometimes nearly black, sometimes purplish brown and at other times deep reddish brown. In many eggs the blotches are quite small and scanty in number, the specks and spots being dominant; in a few eggs the blotches are vary large and then usually confined to the larger end, though they very seldom form rings or caps. I have one clutch with a sandy yellow ground freely speckled all over with blackish brown; another has a warm buff-brown ground with a few large blotches of purplish-brown at the larger end while a third is a dull oily yellow-brown minutely speckled with deep red-brown, the specks in one egg being confined to the larger end.

In shape and texture the eggs are just the same as those of the Grey Phalarope.

One hundred eggs average 29.6 × 20.9 mm.; maxima *32.0* × 21.3 and 31.0 × *22.2* mm.; minima *26.7* × 19.7 and 22.6 × *19.3* mm.

They are undoubtedly single-brooded. The cock bird alone incubated and the Finns say that incubation takes 15 days.

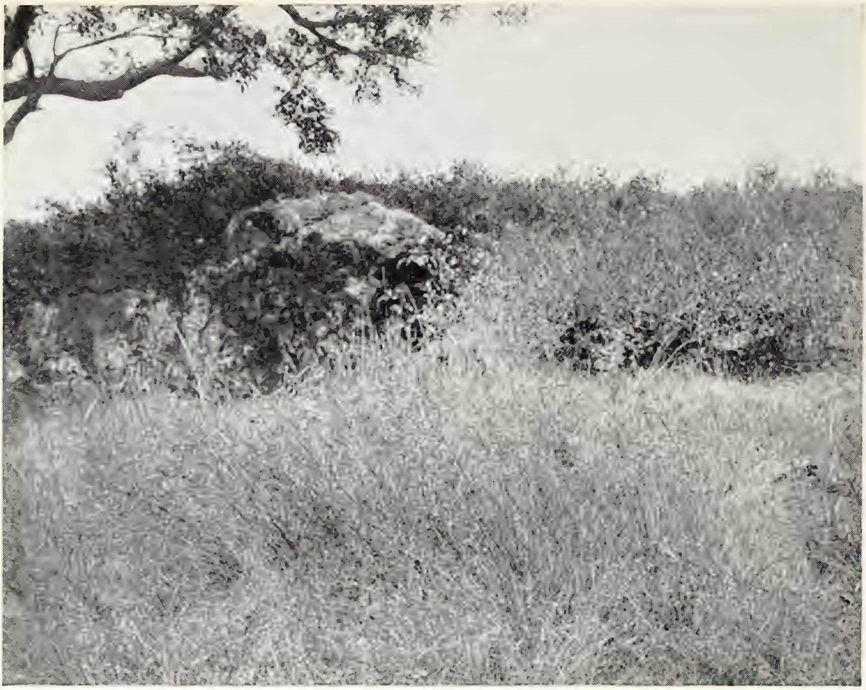
*Habits.*—The Red-necked Phalarope arrives in India in the last week of August or the first week in September and then in increasing numbers to the end of the month. I think it occurs inland on migration only but in many coastal districts it is found all the Winter and on the great tidal rivers of Eastern Bengal it may be constantly seen in flocks, often of some size, from October to April, frequenting not only the muddy banks of the rivers but the swamps and marshes near them. Ticehurst has a very interesting note on this species in Sind (Ibis, 1924, p. 126). Here it appears to be a passer-through on its Southern journey in September but on the return journey, it seems to go straight on North without a break. At the same time some must stop all the Winter as he says, 'During their winter sojourn off the Sind coast they never come to land, as the sea is never so rough they cannot ride it out'. He also remarks, 'It may be met with in flocks of twenty to a hundred or more, sometimes within a few miles of land, but more often well out to sea. Here they are extremely wild and seldom let a boat come within 200 yards of them', yet inland 'on any small pool or shallow jheel little parties may be met with swimming about. . . . At those times they are absurdly tame.'

This tameness and utter fearlessness of man is their most remarkable characteristic and even when they are on waters frequented by other waders and birds it is seldom they are startled into flight by the sudden departure of the other birds when man gets too close.

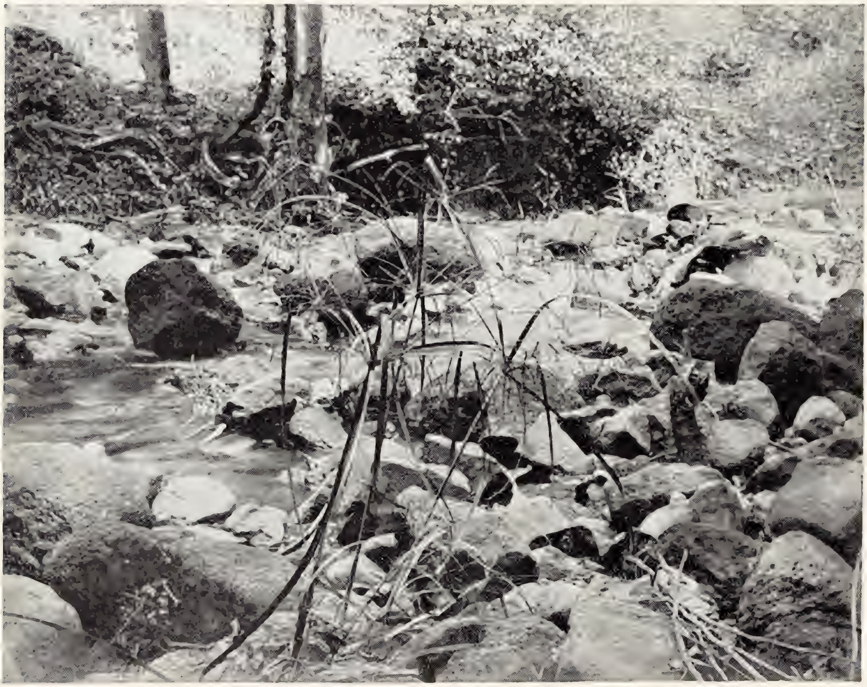
They swim far more than wade, sitting very high on the water and moving with great ease and celerity, often darting hither and thither after surface insects but more often daintily picking at odd flies here and there as they leisurely make their way about. They feed on insects of all kinds and also on shoots and seeds of many water plants; some I watched in Lapland were eating small water snails which were feeding on the grass in the swamp. On the islands they were apparently feeding on small shrimps, crustacea and mollusca.

In the swamps where they were nesting both male and female constantly uttered a soft chirring note to one another and they had a sharp but not loud note sounding like 'twit-twit' generally uttered when we first approached.

Their flight is very much like that of the Stints and equally strong but, as a rule, less sustained. When they rise off the nest the flight is very like that of a Dunlin and they occasionally indulge in the same antics, feigning a broken wing or leg, to draw the intruder away.



Formation of *P. globosus* Reichb. interspersed with *C. eleusinoides* Kunth at Panchgani.



*Cyperus nutans* Vahl, growing among bolders of a stream south of the Tulsi Lake, Salsette Island.

*Photos by C. McCann.*

# REVISION OF
# THE FLORA OF THE BOMBAY PRESIDENCY.

BY

The Late E. Blatter, s.j., ph.d., f.l.s.

Part XXIV.

(*Continued from page 35 of this volume*).

## CYPERACEAE

BY

E. Blatter, s.j., Ph.D., f.l.s. and C. McCann, f.l.s.

(*With 3 plates and one block*).

### 4. Cyperus Linn.

Annual or perennial erect or floating herbs. Leaves usually radical, flat or terete and channelled, rarely entirely reduced to sheaths. Inflorescence capitate or of simple or compound umbels; bracts like the leaves, rarely reduced almost to scales, usually divaricate, sometimes one erect. Spikelets linear or oblong, usually compressed, seldom terete. Rhachilla persistent, often winged, the wings often interrupted and in pairs opposite the nuts, sometimes united to the glumes. Glumes usually distichous, the 2 lowest empty, 4-many succeeding ones bisexual, the uppermost 1-3 sterile or empty. Stamens 3 or 2, rarely 1; anthers sometimes crested. Style 3-fid, rarely undivided, not tumid at the base nor articulated to the nut. Nut usually 3-gonous, less often plano-convex.

Species about 300.—All warm and temperate regions.

A most difficult genus and in our opinion badly in need of revision. Herbarium material alone is very misleading in the identification of the numerous species. Some of the species are incompletely described and from the descriptions alone may as well be united, as there are no specific differences of real value.

Cooke has 44 species. But then we must remember that his *Cyperus* includes 9 species of *Pycreus*, 3 species of *Juncellus* and 5 species of *Mariscus*. He described, therefore, 27 species of *Cyperus* as considered in this paper. We have united his *C. tegetum* and *C. tegetiformis* with *C. corymbosus*, and again his *C. tuberosus* with *C. rotundus*, so that of Cooke's species there remain 24. Of species new to the Presidency we have added 11.

I. Anosporsum. Style long, undivided or obscurely 3-2-toothed ... ... ... 1. *C. Cephalotes.*
II. Pycnostachys. Inflorescence umbellate throughout or capitate; spikelets digitate or clustered, not spicate. Style-branches linear, rarely linear-lanceolate
  1. Style-branches linear-lanceolate. Nut corky below ... ... ... 2. *C. platystylis.*
  2. Slender annuals. Umbel very rarely reduced to a single head. Spikelets small. Glumes mucronate
    a. Nut not broader upwards ... ... 3. *C. castaneus.*
    b. Nut broader upwards ... ... 4. *C. uncinatus.*
    c. Nut broadly obovate, suddenly cuneate towards the base ... ... 5. *C. Meeboldii.*

3. Small or middle-sized, annuals or biennials, rhizome O, or in *C. Haspan* creeping. Leaves and bracts moderately long, narrow, weak. Inflorescence umbellate, sometimes reduced to a single head. Spikelets small, numerous. Glumes scarcely cuspidate
a. Spikelets innumerable in globose heads, green to blackish ... ... 6. *C. difformis.*
b. Spikelets fewer in each head
¶ No stolons
† Nut broadly ellipsoid ... ... 7. *C. pulcherrimus.*
†† Nut globosely trigonous, granulate 8. *C. flavidus.*
¶¶ Stoloniferous, nut usually triquetrous 9. *C. Haspan.*
4. Rhizome woody, very short; rootlets wiry. Inflorescence of one head
a. Glumes very acute, conspicuously mucronate. Nut obovoid, triquetrous, with concave faces, reticulate, black and white ... ... ... 10. *C. Teneriffae.*
b. Glumes muticous. Nut sessile, oblong-obovoid, trigonous, black ... ... 11. *C. niveus.*
c. Glumes oblong-obtuse, obscurely 3-1-nerved. Nut oblong, black, white-reticulate ... ... ... 12. *C. leucocephalus.*
5. Rhizome woody, creeping; rootlets thick, often woolly. Inflorescence umbelled or with one head
a. Spikelets in one head, dirty straw-coloured ... ... ... 13. *C. arenarius.*
b. Spikelets in a contracted umbel, pinkish grey, roots woolly ... ... 14. *C. conglomeratus.*
c. Like b, but with many-flowered spikelets and densely crowded glumes ... 15. *C. effusus.*
d. Spikelets in a contracted umbel, roots wiry ... ... ... 16. *C. Atkinsoni.*

III. CHORISTACHYS. Inflorescence umbellate, spikes often more or less corymbed. Spikelets (sometimes very shortly) spicate. Style-branches linear
1. Rhachilla of spikelets not much winged. Leaves and bracts long (except in *C. malaccensis*)
a. Annuals, or sometimes flowering the second year
¶ Spikelets compressed; glumes green on the sides ... ... ... 17. *C. compressus.*
¶¶ Glumes nearly always reddish on the sides ... ... ... 18. *C. glaber.*
¶¶¶ Glumes squarrose ... ... 19. *C. aristatus.*
¶¶¶¶ Glumes distant, obtuse, golden yellow 20. *C. Iria.*
b. Rhizome becoming woody; elongate stolons frequent. Large or middle-sized
¶ Perennials. Rhachilla of spikelets not much winged, slender. Glumes (mature) with concave backs, not appressed
† Spikelets very slender, almost filiform, spreading stellately, glumes very distant ... ... ... 21. *C. distans.*
†† Spikelets less slender, secund, in tassel-like clusters on the ends of the very long rays ... ... 22. *C. nutans.*

††† Spikelets less slender, firm, erect, or spreading ... ... ... 23. *C. eleusinoides.*
¶¶ Leafy perennials. Spikelets compressed. Glumes closely imbricating with scarious margins and tips. Tall herbs of marshes
† Rhachis of spike pilose-scabrid ... 24. *C. pilosus.*
†† Rhachis of spike glabrous ... 25. *C. procerus.*
¶¶¶ Maritime herbs with terete pale spikelets. Glumes crisply incurved all round ... ... ... 26. *C. malaccensis.*
2. Rhachilla of spikelets (usually conspicuously) winged
a. Stolons slender, soon disappearing, terminating in tunicated bulbils ... 27. *C. bulbosus.*
b. Stolons long, hardening into creeping rhizomes. Leaves short, rarely half the length of the stem. Glumes approximate, closely imbricate
¶ Bracts 1-3, scale-like, triangular, acute, under 2.5 cm. long ... ... 28. *C. articulatus.*
¶¶ Bracts 3-5, linear ensiform, shorter or longer than the inflorescence ... 29. *C. corymbosus.*
c. Rhizome very short, woody; stolons 0, i.e. lateral shoots from base of stem immediately ascending. Glumes not imbricate in fruit. Wings of rhachilla narrow-oblong, hyaline, disappearing 30. *C. macer.*
d. Tall or medium plants, stoloniferous or rhizome woody. Leaves and bracts long. Rhachilla of spikelets winged. Glumes closely imbricated
¶ Leaves flaccid, flat, umbels expanded, usually compound
† Tubers not zoned ... ... 31. *C. rotundus.*
†† Tubers zoned ... ... 32. *C. esculentus.*
¶¶ Leaves rigid, filiform or very narrow; umbel simple, compact ... 33. *C. stoloniferus.*
e. Tall, stout. Stolons 0. Leaves and bracts long. Umbel large, compound. Spikes and spikelets many. Rhachilla of spikelets conspicuously winged. Anthers apiculate, not rarely crested. Style with its 3 branches small. Nut small, ashy black
¶ Spikelets much compressed, ascending, wings persistent ... ... 34. *C. exaltatus.*
¶¶ Spikelets terete, spreading horizontally, wings deciduous ... ... 35. *C. digitatus.*

1. **Cyperus Cephalotes** Vahl Enum. ii, 311.—*C. monocephalus* Roxb. Fl. Ind. i (1832) 188.

*Description*: Glabrous, floating in tanks; stolons slender. Stems 10-40 cm. Leaves 2-5, as long as ⅔ stem, 4 mm. broad. Bracts 3-5 up to 10-20 cm., leaf-like. Inflorescence of one compound dense head; heads 3-20 mm. diam. Spikelets 10-70, 6-13 by 3 mm., compressed, rigid, often bent, 10-36-flowered; rhachilla stout, persistent, angular, hardly winged. Glumes closely packed, boat-shaped, green, more or less marked with red or chestnut. Stamens 3-2; filaments broadly ligulate; anthers large, linear-oblong, muticous. Nut stipitate, below corky, half length of glume, ovoid, unequally trigonous (i.e. somewhat plano-convex) passing gradually into the linear style ⅔ length of nut.

*Locality*: *N. Kanara*: Tank between Mundgod and Haliyal, 2,000 ft., rainfall 40/45 in. (Sedgwick 2404 !); Kirwultu, from tank (Talbot 1125 ! 1539 !).

*Flowering & fruiting*: January 5th, 1885 (Kirwultu); March 1917 (Mundgod to Haliyal).

*Field notes*: Forms floating islands in association with *Pistia stratiotes* in a very few tanks in the above Ghat talukas of N. Kanara (Sedgwick).

*Distribution*: From Bengal to Madras, Cochin, Travancore, N. Kanara, Burma.—China, Malaya, Australia.

2. **Cyperus platystylis** R. Br. Prodr. 214.—*Anosporum pallidum* Boeck. in Linnaea xxxvi, 412.

*Description*: Glabrous, floating in tanks. Stolons covered by ovate acute striate pale brown scales. Stems solitary, 15 cm. to 1.05 m. Leaves often as long as stem, up to 8-13 mm. broad, coarse, cutting, nerves many, strong. Umbel 2.5-25 cm. diam.; bracts 20-45 cm. leaf-like, somewhat corymbose. Umbel compound. Spikes near together, often very numerous. Spikelets 5-1,300, 1-6-together digitate, 13 by 3 mm., 20-40-flowered, brown pale or reddish; rhachilla persistent, scarcely winged. Glumes very close-packed, boat-shaped, back with 3 green nerves. Stamens 3; filaments ligulate; anthers linear-oblong, crested with a small linear-lanceolate red mucro. Nut ellipsoid, $\frac{2}{3}$ length of glume, unequally trigonous, pale brown, corky cells of the angles straw-coloured; style much shorter than nut, deciduous, branches as long as style.

*Locality*: *N. Kanara*: Devimane Ghat (Kulkarni ! 2 sheets); Sirsi (Chibber !).

*Flowering & fruiting*: May 20th, 1911 (Sirsi); November 20th, 1908 (Devimane).

*Distribution*: From Bengal and Burma to Ceylon and Penang, N. Kanara.

3. **Cyperus castaneus** Willd. Sp. Pl. i (1797) 278; Cke. ii, 861.

*Description*: Cke. l.c.

We have examined two sheets identified by C. B. Clarke as *C. castaneus*. The filaments are sometimes long and sometimes short. At times there are two, three and one stamen; style 2-fid, occasionally 3-fid.

*Locality*: *Konkan*: (Cooke); Bombay (Woodrow ex Cooke); Laddapur (Bhiva ex Cooke), open grassland (H.E.B.B. !).

*Flowering & fruiting*: September 7th, 1892 (Laddapur).

*Distribution*: From E. Nepal to Ceylon and Prak.—Tonkin, Central Australia.

4. **Cyperus uncinatus** Poir. Encyc. Méthod vii (1806) 247; Cke. ii, 862.—*C. cuspidatus* H.B. & K. Nov. Gen. *et* Sp. i (1815) 204.

*Description*: Cke. l.c.

*Locality*: *Sind* (Pinwill ex Cooke).—*W. Ghats*: Lonavla (Woodrow ex Cooke).

*Distribution*: Throughout India.—Common in all tropical and warm temperate countries.

5. **Cyperus Meeboldii** Kükenthal in Fedde Report *spec. nov.*. xviii (1922) 315.

*Description*: No rhizome. Root fibrous. Stems several, caespitose, 6-10 cm. high, setaceous, slightly curved, triangular, smooth, at the base bulbous-thickened, sheaths brown, split into fibres, few-leaved below. Leaves setaceous, canaliculate, as long as the stems. Spikelets 12, oblong, 6 mm. long, scarcely 2 mm. broad, compressed, stellately united into one globose, 8-12 mm. broad head. Bracts 2-3, very much spreading, the lowest quasi a continuation of the culm, much longer than the inflorescence. Rhachilla straight, firm, wingless. Glumes densely imbricate, membranous, fuscescent, 3-nerved from the keeled back, broadly green, excurrent into a short, strong, outward-curved mucro. Nut small, scarcely $\frac{1}{3}$ of the glume, broadly obovate, towards the base suddenly cuneately contracted, trigonous, blackish brown, densely elevately punctate, apiculate. Style short. Stigmas 3, thin. Stamen 1.

*Locality*: *S. M. Country*: Badami, 2,000-3,000 ft. (A. Meebold 11257).

*Note*.—According to Kükenthal this species resembles *C. pumilis* Linn. The spikelets and glumes are very similar. But the nuts are trigonous and the style has 3 stigmas. *C. Meeboldii*, therefore, is a true *Cyperus*, not a *Pycreus*. It would be best to put it between *C. jucundus* and *C. Schlechteri*,

from both of which it can be easily distinguished by the nut being cuneately narrowed towards the base.
*Distribution*: Endemic.

6. **Cyperus difformis** Linn. Cent. Pl. pt. 2 (1755), in Amoen. Acad. iv (1788) 302; Cke. ii, 862.
*Description*: Cke. l.c.
Rhachilla narrowly, but distinctly winged by the decurrent margin of the glume.
*Locality*: *Gujarat*: Kabir Vad, Broach (Gammie !); Sevalia, Kaira Dist. (Chibber !); Vasvad (Chibber !); in sandy bed of stream Chitrasani to Sarotra (McCann 1372 !).—*Khandesh*: Talner, Tapti bank (Blatter & Hallberg 3019 !); Nimb, Tapti River (Blatter & Hallberg 1931 ! 3097 !); Bori River (Blatter & Hallberg 1928 !); Bor, Bori River (Blatter & Hallberg 3024 !, sandy mud 3031 !); Bhusawal (McCann 3088 !); Dadgaum (Blatter, Hallberg & McCann 29582 !).—*W. Ghats*: Khandala (Woodrow ex Cooke); marshes (Sedgwick 2551 !, McCann C92 !, Blatter & McCann 3155 ! 3168 !); Purandhar (Blatter & McCann 5574 !); Igatpuri (McCann 2389 !, Blatter & Hallberg 3209 ! 5119 !); Igatpuri to Kasara (McCann 2389 !); Trimbak (H.E.B.B. !); Matheran (Woodrow ex Cooke).—*Deccan*: Poona, riverside (Bhide 20 !); between Nadsur and Pali, in rice fields (Gammie 16024 !); Ganeshkhind Gardens (Garade 432 !); Bhandala (H.E.B.B. !); Bopodi, near Poona (Gammie 15307 !); Chinchwad, near Poona (Woodrow ex Cooke); between Ellora and Poona (Jacquemont 275 ex Cooke).—*Konkan*: Uran, Bombay Harbour (Hallberg & McCann 2734 ! 2747 !); Pen (Blatter, Hallberg & McCann 3236 !); Bhandup (Blatter & McCann 2419 !); Nagothna to Pen (Gammie 16091 !).—*S. M. Country*: W. of Dharwar, rice fields, 2,000 ft., rainfall 35 in. (Sedgwick 2254 !).—*N. Kanara*: Karwar (Hallberg & McCann C94 ! C98 !, Talbot !); Banks of Kala Nuddi (Talbot 1000 !); Dandeli (Talbot 2271 !); Kilgerry (Talbot 2619 !).
*Flowering & fruiting*: January 1917 (Uran; Igatpuri); January 11th, 1890 (Dandeli); February 1917 (Pen, W. of Dharwar); March 1917 (Khandala); May 1919 (Khandala); May 8th, 1902 (Poona, riverside); June 1917 (Bhandup); June 13th, 1902 (Ganeshkhind); July 1917 (Khandala); August 13th, 1902 (Bopodi); August 15th, 1891 (Kilgerry); September 1885 (Karwar); September 1914 (Wadaj); September 1918 (Khandala); September 6th, 1911 (Kulgeri, tank); September 13th, 1919 (Ahmedabad); September 20th, 1895 (Bhandala); October 1917 (Igatpuri Ghats); October 1919 (Karwar); October 24th, 1914 (Talod); October 24th, 1929 (Chitrasani to Sarotra); November 30th, 1907 (Trimbak); December 1916 (Bhusawal, Taler, Nimb, Bor, Bori River); December 1917 (Purandhar); December 1918 (Dudgaon); December 3rd, 1907 (Sevalia); December 9th, 1902 (Between Nadsur and Pali); December 14th, 1902 (Nagothna to Pen); December 20th, 1904 (Kabir Vad); December 29th, 1911 (Vasvad).
*Field notes*: A plant met with at any time of the year, generally in sandy soil, in or near streams or other damp places.
The dense round heads of the umbel distinguish it readily. The glumes are at first pale green tinged with reddish brown or purple on the sides, but eventually turn brown—almost the colour of burnt umber in herbarium specimens. Flowers throughout the year under favourable conditions. Specimens collected during the monsoon (late) are best developed.
*Distribution*: Throughout India and the Old World.

7. **Cyperus pulcherrimus** Willd. in Kunth Enum. ii (1837) 35; Cke. ii, 863.
*Description*: Cke. l.c.
*Locality*: *Sind*: (Pinwill ex Cooke).
*Distribution*: Sind, Bengal, Assam.—Ceylon, Penang, Java, Borneo.

8. **Cyperus flavidus** Retz. Obs. v (1789) 13; Cke. ii, 862.—*C. Haspan* var. *indicus* Boeck. in Linnaea xxxv (1868) 574.
*Description*: Cke. l.c.
The specimen recorded for Cutch, viz. Blatter 1972, may possibly be the plant which was identified as *C. Haspan*.
Nut minute, 0.4 mm., trigonous, sometimes certainly appearing plano-convex, marble white, granulate, frequently adhering to the rhachilla long after the

fall of the glume. Style 0.5-0.8 mm. long; stigmas 3, linear, occasionally 2, three-fourths the length of the slender style; styles often remain attached to the nut. Glumes deciduous from below upwards. Spikelets up to 10 mm.

*Locality*: *Cutch*: (Blatter 1972 !).—*Gujarat*: Talod, just out of water, by roadside pond (Saxton 562b !); Sonasan, by a small tank (Sedgwick 332 !); Mehemnagar, near Ahmedabad, rice fields (Sedgwick 331 !).—*W. Ghats*: Igatpuri (Blatter & Hallberg 2801 ! 2802 !, McCann 2388 !); Tingalwadi, Igatpuri (Blatter & Hallberg 1999 !); Khandala (Blatter & McCann 2754 ! 3180 !); Matheran (Gammie 16642 !); Lonavla, in a marsh near Walwan Lake (McCann 1586 !); Castle Rock, on Duski River bank (McCann C126 !).—*Deccan*: (Dalzell & Gibson ex Cooke); Bhusi, Mawal, Poona (Supt. Lonavla Farm 6 !); Sakar Pathar (Gammie 15904 !).—*Konkan*: Pen (Blatter, Hallberg & McCann 3232 !); Uran, Bombay Harbour (Hallberg & McCann 2738 !); Bhandup (Blatter & McCann 2743 !); Mulgaon (Blatter & McCann 3083 !); Andheri (Blatter & McCann 3090 !); Gokhirwa, Bassein (Ryan 86 !); Borivli to Kanari Caves (McCann 1127 ! 1128 !); Vetora (Sabnis 33234 !); Varol Tank, near Bhivandi (McCann 1722 !).—*S. M. Country*: Dharwar, 2,400 ft., rainfall 34 in. (Sedgwick 4976 !); Dastikop, rice fields, 2,500 ft., rainfall 35 in. (Sedgwick 1901 !); Havasbhavi, rice fields 1,800 ft., rainfall 35 in. (Sedgwick 1995 !); Bidi, Belgaum Dist., 2,500 ft., rainfall 60 in. (Sedgwick 2996 !).—*N. Kanara*: Siddhapur, rice fields 1,600 ft., rainfall 100 in. (Sedgwick 7013 !); Yellapur Tank (Talbot 925 !); Karwar, borders of rice fields (Talbot !).

*Flowering & fruiting*: January 1917 (Igatpuri, Uran); February 1917 (Pen); February 28th, 1884 (Yellapur); March 1917 (Khandala); March 1919 (Castle Rock); May 1918 (Vetora); August 10th, 1885 (Karwar); September 1884 (Yellapur); September 1917 (Igatpuri, Bidi, Lonavla); September 15th, 1929 (Borivli to Kanari Caves); October 1914 (Mehemnagar); October 1917 (Igatpuri); October 1919 (Siddhapur); October 24th, 1914 (Talod); October 26th, 1918 (Lonavla); November 1916 (Bhandup, Khandala, Dastikop); November 12th, 1907 (Bhusi); November 21st, 1902 (Gokhirwa); November 30th, 1929 (Lonavla); December 1907 (Cutch); December 1916 (Havasbhavi, Mulgaon, Andheri); December 1918 (Dharwar); December 1st, 1903 (Matheran); December 5th, 1902 (Sakar Pathar).

*Field notes*: A monsoon species, but may be met with all the year round in suitable localities. Usually found growing in soft sticky soil of fields and pools. A pest of rice fields; fortunately (as far as we have seen) this plant has no stolons but this is compensated by the large umbel with its minute, numerous seeds. It commences to flower in early September and carries on till the fields are dry.

Its large divaricate umbel, too large for the size of the plant, is unmistakable. Inflorescence at first pale yellow, eventually turning brown. Stems 3-gonous, with a ridge on every side making it appear hexagonous until cross-sectioned.

*Distribution*: More or less throughout India, Ceylon.—The Old World, generally in warm regions.

9. **Cyperus Haspan** Linn. Sp. Pl. (1753) 45; Cke. ii, 863.

*Description*: Cke. l.c.

We are much inclined to believe that the record for Cutch is not correct as this species is a plant inhabiting heavy rainfall country. We have not seen specimens in any herbarium from the drier parts of the Presidency.

This species is exceedingly difficult to separate from good specimens of *C. flavidus*.

We are of opinion that the Cutch and Deccan specimens are more likely *C. flavidus* and not *C. Haspan*.

*Locality*: *Cutch*: (Blatter ex Journ. Bom. Nat. Hist. Soc., Flora of Cutch). —*Konkan*: Ratnagiri (Woodrow ex Cooke; Herb. Col. of Sc. Pa. now in Calcutta !; H.E.B.B.); Vetora (Sabnis 3371 !).—*W. Ghats*: Lonavla (Woodrow ex Cooke); Castle Rock, 1,700 ft. rainfall 200 in. (Sedgwick 5600 !, Gammie 15765 !, Bhide !).—*N. Kanara*: 30 miles E. of Karwar, rivulet by road, 400 ft., rainfall 150 in. (Sedgwick 6571 !); Devimane Ghat, 600 ft., rainfall 250 in. (Sedgwick 6950 !); Sulgeri, 1,000 ft., rainfall 200 in. (Bell 4246 !); Ramangoli, 1,000 ft., rainfall 200 in. (Sedgwick 3475 !); Anmod, rice fields, 2,000 ft., rainfall 200 in. (Sedgwick 3275 !); Yellapur (Talbot !), Arbail Ghat, 1,800 ft., rainfall 200 in. (Sedgwick 5846 !).

*Flowering & fruiting*: February 28th, 1884 (Yellapur); March 1919 (Castle Rock); April 1919 (Yellapur, Arbail Ghat); August 1918 (Sulgeri); October 1918 (Vetora); October 1919 (Karwar, Devimane); October 27th, 1902 (Castle Rock); November 10th, 1911 (Castle Rock); December 1917 (Anmod); December 1919 (Ramangoli); December 25th, 1893 (Ratnagiri).

*Field notes*: A weak looking plant with very large umbels.

*Distribution*: Confined to the heavy rainfall areas of the Bombay Pres., throughout India, in marshy localities and in rice fields.—Ceylon, Malaya, Indo-China, tropical Africa and Australia.

10. **Cyperus Teneriffae** Poir. Encycl. Méthod. vii (1806) 245; Cke. ii, 861.—*C. Wightii* Nees in Wight Contrib. (1834) 78.—*C. rubicundus* Kunth Enum. ii (1837) 49 (*non* Vahl).

*Description*: Cke. l.c.

*Locality*: *Deccan*: Poona (Woodrow 143 ex Cooke, Herb. St. X.C. 3140 !); Gungapur, Nasik (Blatter & Hallberg C102 !).—*S. M. Country*: Varavandi, Ahmednagar Dist. (Herb. Sedgwick 7387 !); Dharwar, weed on poor land, 2,400 ft., rainfall 35 in. (Sedgwick 2880 !).

*Flowering & fruiting*: February 1920 (Varavandi); September 1917 (Gangapur, Dharwar).

*Field notes*: Confined to the drier open tracts of the Presidency. A very characteristic species.

*Distribution*: Deccan, S. M. Country, Nallamalai Hills, Coromandel, Nilgiris, Anamalai Hills, Travancore.—S. and tropical Africa, Teneriffe, Madagascar, Arabia.

11. **Cyperus niveus** Retz. Obs. v (1789) 12; Cke. ii, 864.

*Description*: Cke. l.c.

*Locality*: Without locality (Dalzell, H.I.F.I. !).—*Sind*: (Pinwill ex Cooke); Hyderabad (Woodrow ex Cooke).—*Gujarat*: Ahmedabad, sandy hills (Sedgwick !, Saxton 1718 !), on cultivated and waste land fairly common (Saxton 1718b !); Bodeli (Col. of Sc. Herb. now in Calcutta !, Woodrow !).

*Flowering & fruiting*: July 1914 (Ahmedabad); July 6th and 12th, 1919 (Ahmedabad).

*Distribution*: Confined to the dry sandy tracts of the Presidency, Rajputana, N. Circars up to 1,500 ft., Rampa, more or less throughout India.—Afghanistan, China.

12. **Cyperus leucocephalus** Retz. Obs. v (1789) 11; Cke. ii, 864.

*Description*: Cke. l.c.

*Locality*: Without locality (Dalzell, H.I.F.I. !).—*Konkan*: Parol, Bassein Range (Ryan 2442 !); Kaman, Bassein (Ryan 1160 !); Vetora (Sabnis 33553 !); N. & S. Konkan (Law ex Cooke).—*S. M. Country*: Devarayi, 1,800 ft., rainfall 90 in. (Sedgwick 4039 !); Astoli, in grass near forest, 2,000 ft., rainfall 100 in. (Sedgwick 2607 !).—*N. Kanara*: Karwar, rice fields (Talbot !).

*Flowering & fruiting*: May 1918 (Vetora); June 1918 (Devarayi); July 1917 (Astoli); July 26th, 1904 (Parol); August 10th, 1885 (Karwar); August 19th, 1903 (Kaman).

*Distribution*: Konkan, S. M. Country, N. Kanara, Deccan, Madanapalle, Cuddapah, Martaban.—Tropics generally.

13. **Cyperus arenarius** Retz. Obs. iv (1786) 9; Cke. ii, 864.—For synonyms see F.B.I. vi, 602.

*Description*: Cke. l.c.

'Rhizome slender, creeping, 12 inches or more, below the shoots erect' (Saxton).

Stems up to 59 cm. excluding the inflorescence. Inflorescence occasionally with 3 rays with 6-8 sessile spikelets. Rays 15 mm. long. Bracts 5, the longest up to 21 cm. diminishing in size (upwards) to 7 mm., the smallest being lost among the spikelets.

*Locality*: Without locality (Dalzell H.I.F.I. !).—*Sind*: (Pinwill ex Cooke, Stocks ex Cooke); Karachi, by railway line (Hooper 38717 !, Dalzell Herb. Calc. !); Gharo (Blatter & McCann D718 !); Jamadar ka Landa near Karachi

(Stocks ex Cooke).—*Cutch*: on the sea coast (Blatter ex J.B.N.H.S.).—*Gujarat*: Ahmedabad (Woodrow 21 ex Cooke, H.E.B.B. !), river bed (Sedgwick 7416 !), dry sand hills (Sedgwick !); Sarkhaj road, sand area, close to river, Ahmedabad (Saxton 1781 !); in deep sand, Chitrasani to Sarotra (McCann 1364 !); Dumas near Surat, on the sea-coast (Dalzell ex Cooke); Tithal, Bulsar, sand dunes (Chibber !).—*Konkan*: Shore, Salsette-Bombay (Blatter Herb. Sedgwick 3582 !); Juvem, Salsette (Blatter, Hallberg & McCann 3040 !); Bassein (Paranjpye !); Versova, sand dune (Blatter, Hallberg & McCann 29574 !).—*N. Kanara*: Karwar, sandy seashore (Sedgwick 5082 !, Talbot 553 ! 663 ! 997 ! 1533 ! 1536 !).

*Flowering & fruiting*: March 1918 (Salsette); July 1914 (Ahmedabad); July 1918 (Versova); July 1920 (Ahmedabad); July 30th, 1883 (Karwar); August 2nd, 1919 (Ahmedabad); August 9th, 1912 (Bassein); August 12th, 1912 (Karachi); September 1916 (Juvem); September 20th, 1885 (Karwar); October 24th, 1929 (Chitrasani to Sarotra); December 1918 (Karwar); December 27th, 1911 (Tithal).

*Field notes*: A species of sandy localities. In the Palanpur State we have found this species growing in dry, sandy river beds, which are dry for the greater part of the year. The culms and roots descend deep into the earth making it difficult to extract.

*Distribution*: India, sea-coast from Sind to Ceylon and Orissa, Punjab Plains, Rajputana.—Persia, Arabia.

14. **Cyperus conglomeratus** Rottb. Descr. *et* Ic. (1773) 21, t. 15, fig. 7; Cke. ii, 865.—*C. pungens* Boeck. in Linnaea xxxv (1868) 537.

*Description*: Cke. l.c.

*Locality*: *Sind*: (Pinwill ex Cooke); Karachi (Ticehurst 7301 !); Sibi (Lace 3462 ex Cooke).—*Cutch*: (Blatter ex J.B.N.H.S.).—*Gujarat*: Ahmedabad (Saxton !), sandy hills (Sedgwick !, Woodrow ex Cooke).

*Flowering & fruiting*: July 1914 (Ahmedabad).

*Field notes*: Grows in sandy country in both wet and dry places.

*Distribution*: Sind, Cutch, Gujarat, Baluchistan.—Ceylon, Arabia, Mediterranean region, tropical Africa.

**Var. pachyrrhizus** Trimen MS. ex Hook. f. in Trimen in Fl. Ceylon v (1900) 23; Cke. ii, 866.—*C. pachyrrhizus* Nees ex Boeck. in Linnaea xxxv (1868) 111.

*Description*: Trimen l.c.

*Locality*: *Kathiawar*: Veraval (Woodrow !); Porbandar (Chibber !, Bhide !, Javlekar !, Blatter 3135 !, Woodrow !).—*Konkan*: (Law ex Cooke).

*Flowering & fruiting*: January 7th, 1910 (Porbandar); April 20th, 1909 (Porbandar); December 1891 (Veraval).

*Distribution*: Kathiawar, Konkan, Madras Pres. (coastal sands, Krusadai Island), Laccadive Isles.—Ceylon.

15. **Cyperus effusus** Rottb. Descr. *et* Ic. 22, t. 12, fig. 3.—*C. conglomeratus* var. *effusus* Boiss. Fl. Or. v, 369.—*C. conglomeratus* var. *major* Boeck. in Linnaea xxxv, 544 (*partim*).

*Description*: Spikelets linear, compressed, 20-60-flowered, 8-25 by 2-3 mm., much narrower than in *C. conglomeratus;* glumes most densely packed, scarcely mucronate, otherwise as *C. conglomeratus.*

*Locality*: *Sind*: (Pinwill ex C. B. Clarke).

*Distribution*: Sind.—Arabia, Socotra, Syria, Egypt, tropical Africa.

16. **Cyperus Atkinsoni** C. B. Clarke in Journ. Linn. Soc. xxi (1884) 109; Cke. ii, 865.

*Description*: Cke. l.c.

*Locality*: Without locality: (Dalzell ex Cooke).—*Sind*: (Stocks ex Cooke); Jamadar ka Landa, near Karachi (Stocks ex Cooke).

*Distribution*: Kashmir, N.-W. Himalaya, Sind.

17. **Cyperus compressus** Linn. Sp. Pl. (1753) 46; Cke. ii, 866.

*Description*: Cke. l.c.

*Locality*: *Sind*: (Pinwill ex Cooke).—*Gujarat*: Nadiad (Chibber !); Roho to Chitrasani (Allan, Herb. McCann 1055 !).—*Deccan*: (Dalzell & Gibson ex

Cooke); Deolali (Blatter & Hallberg 2833 ! 2835 ); Lena Hill, Nasik (Blatter & Hallberg 2832 !); Poona (Ranade !, Woodrow ex Cooke), College Garden (Garade 747 !).—*W. Ghats*: Khandala, St. Xavier's Villa (McCann C113 !).—*Konkan*: Bombay, St. Xavier's College grounds (McCann 2399 ! 4238 !); Juvem (Blatter & McCann 3084 !); Bandra (Blatter & McCann 2367 !), foreshore (Vakil C111 !), fields (Vakil C112 !); N.-E. shore of Vehar Lake (McCann 639 ! 640 !).—*S. M. Country*: Badami (Herb. St. X.C. 3136 !); Badami Hills (Paranjpye !).—*N. Kanara*: Karwar (Bell 2697 !), rice fields (Talbot 1254 ! 1305 !); Kumpta (Chibber !).

*Flowering & fruiting*: June 1916 (Bombay); July 1917 (Bombay, Karwar); July 1919 (Bandra); July 7th, 1929 (Vehar Lake); August 6th, 1916 (Bombay); August 12th, 1902 (Poona); August 12th, 1929 (Roho to Chitrasani); September 1885 (Karwar); September 1917 (Lena Hill, Deolali, Bandra); September 1919 (Khandala); September 1st, 1912 (Badami Hills); September 6th, 1912 (Nadiad); September 22nd, 1895 (Poona); November 1891 (Badami); November 1st, 1910 (Kumpta).

*Field notes*: Purely a monsoon species, but may be met with by streams and other water at almost any time of the year. A very prolific species. Very common in the islands of Bombay and Salsette, by roadsides, drains, waste land and on paths.

The period of activity of this species is from a month and a half to two months. These remarks apply to the individual plants (and not to the whole). Soon after the plants have shed their seed new individuals spring up.

A tufted species with many stems arising from the same base; there are no stolons or rhizomes. Possibly the tufted appearance is brought about by a portion of the spikelet germinating in the same spot.

*Distribution*: Throughout India.—In nearly all tropical and subtropical countries.

18. **Cyperus glaber** Linn. Mantiss. (1771) 179.

*Description*: Annual, with fibrous roots, stems triangular-subcompressed, leafy below. Leaves flat, shorter than the stems. Umbels often subcompound; rays 4-8, the central one often the shortest. Bracts unequal, the largest very long; spikelets very closely spicate, more or less red-tinged, linear-lanceolate, compressed, subsessile; glumes muticous or very nearly so, ovate-oblong with a green keel, the sides 3-nerved, purplish, white-margined, obtuse, the keel excurrent, mucronulate; rhachis not winged; stamens 3; style 3-fid. Nut black, obovate, triquetrous, minutely conic-apiculate.

*Locality*: *Sind*: (Pinwill ex C. B. Clarke).

*Distribution*: From Sind westward to Sicily.

19. **Cyperus aristatus** Rottb. Descr. *et* Ic. (1773) 23, t. 6, fig. 1; Cke. ii, 866.

*Description*: Cke. l.c.

*Locality*: *Gujarat*: Ahmedabad, sandy places (Sedgwick !), nala near Wadaj (Sedgwick 306 !).—*W. Ghats*: Khandala (Blatter, Hallberg & McCann 2403 ! 2404 ! 3064 !); Purandhar Fort (Bhide 988 !); Panchgani, very common (McCann !); Londa, on wet rocks (Gammie 15860 !).—*Deccan*: Gungapur, Nasik (Blatter & Hallberg 2837 !); Lena Hill, Nasik (Blatter & Hallberg 2363 !); Deolali (Blatter & Hallberg 4557 !); Talegaon (Herb. St. X.C. 3134 !); Khadkalla to Talegaon (Woodrow !); Poona (Talbot !, Jacquemont 315 ex Cooke, Woodrow ex Cooke), Parvati Hill (H.E.B.B. !); Kirkee, Mr. Gammie's compound (H.E.B.B. 903 !); Khed (Paranjpye !); Shivneri Fort, Junnar (Paranjpye !).—*Konkan*: Kondita, Salsette Isl. (Blatter & McCann 1852 !); Bombay, Antop Hill (Blatter & McCann 2424 ! 2448 !); Victoria Gardens (Blatter & McCann 2391 !), St. Xavier's College grounds (McCann 2847 !); Bandra (Ryan 1256 !), seashore (Gammie 2482 !); Alibag Fort (Bhide !); Narel (Herb. Col. of Sc. Pa. now in Calc. !).—*S. M. Country*: Dharwar, 2,400 ft., rainfall 34 in. (Sedgwick 2943 ! 6196 ! 6357 !, Talbot 2620 !); Badami Hills (Paranjpye !).—*N. Kanara*: Karwar, sea-face, rainfall 120 in. (Sedgwick 6711 !).

*Flowering & fruiting*: July 1914 (Ahmedabad); July 1917 (Condita); July 1919 (Bombay, Khandala); August 1917 (Antop Hill); August 1919 (Dharwar);

August 8th, 1904 (Bandra); August 10th, 1904 (Bandra); August 15th, 1891 (Dharwar); August 21st, 1891 (Narel); August 30th, 1903 (Bandra); September 1888 (Parvati Hill); September 1914 (Wadaj); September 1917 (Lena Hill, Deolali, Dharwar, Gangapur); September 1919 (Dharwar); September 1st, 1902 (Kirkee); September 1st, 1912 (Badami Hills); September 10th, 1911 (Shivneri Fort); September 11th, 1911 (Khed); September 22nd, 1902 (Purandhar Fort); September 26th (Khadkalla to Talegaon); October (Talegaon); October 1919 (Karwar); October 9th, 1910 (Alibag Fort); November 3rd, 1902 (Londa).

*Field notes*: An extremely common species in the town of Bombay, soon after the break of the monsoon. It grows in ditches, on walls, pathways, waste land, and is even to be found in choked gutters on roof tops.

The inflorescence is at first quite green, in keeping with the whole plant; but turns brown when mature.

As far as we have been able to judge it grows best on soil containing gravel and lime. Firm soil appears to be preferred on which the plant thrives best.

*Distribution*: More or less throughout India.—Ceylon, tropical Africa, Australia, the whole of America.

20. **Cyperus Irla** Linn. Sp. Pl. (1753) 45; Cke. ii, 867.—*C. Iria* var. *paniciformis* C. B. Clarke in Hook. f. F.B.I. vi, 607.

*Description*: Cke. l.c.

Cooke mentions that the variety *paniciformis* bears two nuts, but does not say how many nuts the species bears.

A sheet in the Herbarium of the Gujarat College, collected by Sedgwick shows the typical species and the variety growing on the same plant.

*Locality*: Without locality (Dalzell H.I.F.I. !).—*Sind*: Karachi, extracted from a bird's crop and grown in a pot, Ticehurst No. 17 (Herb. St. X.C. 28958 !).—*Cutch*: In rice fields (Blatter, ex J.B.N.H.S.).—*Gujarat*: Nadiad (Chibber !); Ahmedabad-Bhadar, famine grass plot (Sedgwick !); Ahmedabad (Blatter 2170 !), nala near Wadaj (Saxton 1816 !), sandy fields (Sedgwick !); Vastrapur, in a flooded field (Saxton 1883 !).—*W. Ghats*: Igatpuri (Blatter & Hallberg 2407 ! 2803 ! 3206 !); Khandala (Woodrow ex Cooke, Sedgwick 2560 !, Blatter & McCann 3162 !, Blatter, Hallberg & McCann 1993 ! 1994 ! 3046 !); Khandala to Campoli (Blatter, Hallberg & McCann 27603 !); Lonavla (H.E.B.B. !); Purandhar (Blatter & McCann 5583 ! 5585 !), Bairawadi Purandhar (Blatter & McCann 5577 ! 5580 !); near Shivapur village, Poona Dist. (Fernandez C157 !); Panchgani (Blatter & Hallberg B1750 !, D'Almeida C209 !, McCann 2982 !); Matheran (Woodrow ex Cooke).—*Deccan*: (Dalzell & Gibson ex Cooke); Nasik, Lena Hill (Blatter & Hallberg 2823 ! 2841 !), Gangapur (Blatter & Hallberg 2824 !); Bopodi, near Poona (Gammie 15308 !); Shivneri Fort, Junnar (Paranjpye !); Poona (Jacquemont 344 ex Cooke); *Konkan*: Pen, rice fields (Blatter, McCann & Hallberg 3235 !); Sion (Blatter & McCann 2364 !); Bombay, St. Xavier's College compound (McCann 2400 !); Mahim (Blatter & McCann 2730 !); Palghar, Mahim (Ryan 1781 !); Trombay, on hill (Blatter & McCann 2827 !); Juvem (Blatter, Hallberg & McCann 3086 !); Bassein (Blatter & McCann 2369 !); Bandra (Ryan 1367 !), fallow fields (Vakil C99 !); Neral (H.E.B.B. !, Bhiva ex Cooke); Parsik (Ryan 1214 !); Mulland (McCann 813 ! 905 !); Borivli to Kanari Caves (McCann 1159 !); Bhandup to Vehar Lake (McCann 646 !).—*S. M. Country*: Devarayi, 1,800 ft., rainfall 90 in. (Sedgwick 4459 !); Dharwar, in water hole, 2,400 ft., rainfall 34 in. (Sedgwick 6208 !); Shiggaon, 2,000 ft., rainfall 35 in. (Sedgwick 2116 !); Badami Hills (Paranjpye !).—*N. Kanara*: Yellapur (Talbot !); Dandeli, 1,800 ft., rainfall 100 in. (Bell 4218 !).

*Flowering & fruiting*: January 1917 (Igatpuri); February 1917 (Pen); March 1917 (Khandala); May 1917 (Khandala); June 1917 (Sion); July 1916 (Khandala); July 1917 (Bombay); July 7th, 1929 (Bhandup to Vehar); August 1908 (Bombay); August 1914 (Ahmedabad); August 1916 (Khandala); August 1917 (Sion, Kanari Caves); August 1918 (Dandeli); August 1919 (Dharwar); August 11th, 1929 (Mulland); August 13th, 1902 (Bopodi); August 16th, 1919 (Wadaj); August 22nd, 1929 (Shivapur); August 23rd, 1903 (Parsik); August 29th, 1919 (Vastrapur); September (Trombay Hill); September 1916 (Juvem); September 1917 (Gangapur, Igatpuri Ghats, Bassein, Bandra); September 1919

(Khandala); September 1st, 1912 (Badami Hills); September 6th, 1912 (Nadiad); September 10th, 1911 (Shivneri Fort); September 15th, 1903 (Jootara); September 20th, 1884 (Yellapur); October 1917 (Igatpuri); October 1918 (Devarayi, Campoli); October 1920 (Panchgani); November 1916 (Mahim); November 2nd, 1905 (Lonavla); November 16th, 1903 (Palghar, Mahim); December 1916 (Shiggaon); December 1917 (Purandhar).

*Cyperus Irea* L. growing in a drain, Khandala.

*Field notes*: Mainly a monsoon plant, but may be met with at any time of the year near water or in marsh land. Appearing soon after the break of the monsoon everywhere. A most variable plant (perhaps the most variable of all the *Cyperaceae*) varying from a fine filamentous form, a few inches high with just one reduced spikelet of a few glumes to a form 0.9 m. high with large compound umbel. Specimens growing in streams usually reach a large size whereas those on 'drier' soil remain small.

A curious point is that the so-called variety *paniciformis* is developed in specimens which have an excess amount of water and hence the 'variety' is a pest in flooded fallow fields. The umbel in this form is usually larger with smaller glumes. In short, the 'type' grows on firm 'drier' soil than the variety. The type is smaller than the variety, with a much more regular umbel, with large glumes.

We have seen specimens of this species presenting both the typical and varietal forms on the same plant; Sedgwick's Nos. 2116 and 6208 are good examples. Under these circumstances and considering the fact that this species is very variable between considerable limits, we have dropped the variety.

The roots in fresh specimens are reddish or reddish purple and aromatic. (This remark applies to the 'form'.)

The form *paniciformis* is more a monsoon form than the typical form but the typical form alone is usually the form met with in marshes during the dry season.

We have also noticed the form *paniciformis* growing on firm soil, but this is seldom the case compared with the vast number found in water-logged soil. In Salsette we have observed it entirely covering fallow fields during the monsoon almost to the exclusion of everything else.

*Distribution*: Throughout India in rice fields.—Ceylon, China, Japan, Malaya, Australia, Persia, Afghanistan, tropical Africa.

21. **Cyperus distans** Linn. f. Suppl. 103; C. B. Clarke in Hook. f. F.B.I. vi, 607.—Synonyms in C. B. Clarke l.c.

*Description*: Glabrous, large or medium sized. Stolons elongate, hardening into a stout horizontal rhizome, but many plants flower the first year. Stems 0.3-0.9 m. long. Leaves often as long (or $\frac{2}{3}$ as long) as the stem, 6-8 mm. broad. Umbel compound, usually open 20-30 cm. in diam., sometimes congested or depauperated; bracts usually overtopping the umbel, similar to the leaves. Spikelets usually spicate (rhachis of the spike 8-50 mm. long), 13-38 by 1 mm., almost acicular, reddish, 10-12-flowered, in fruit divaricate at right angles; rhachilla very slender, not winged, appearing zigzag in the lower half where the glumes have fallen. Glumes very remote, oblong-elliptic, obtuse. Nut $\frac{1}{2}$-$\frac{2}{3}$ the length of the glume, oblong or narrow-ellipsoid, trigonous, dusky-black, style much shorter than the nut; branches 3, shortly exserted.

*Locality*: *W. Ghats*: Lingmala, near the falls (McCann 3409 ! 3426 ! 3427 !); Castle Rock (Gammie 15573 !).—*S. M. Country*: Devarayi, 1,800 ft., rainfall 90 in. (Sedgwick 4432 !); Devikop, 1,800 ft., rainfall 40 in. (Sedgwick 4440 !); Belgaum (D.F.O. 10416 !, Herb. I.F.R.I.).—*N. Kanara*: Yellapur, 1,800 ft., rainfall 100 in. (Sedgwick 6546 !); Siddhapur, 1,600 ft., 100 in. (Sedgwick 7021 !); Karwar (Talbot 1514 !, Hallberg & McCann C198 !).

*Flowering & fruiting*: September 24th, 1930 (Lingmala); October 1918 (Devikop, Devarayi); October 1919 (Yellapur, Siddhapur, Karwar).

*Field notes*: The three specimens obtained by us were partly in forest among other plants on the bank of the Yenna River. The spikelets were rusty brown.

*Distribution*: From the Himalaya to Ceylon and Singapore.—In nearly all warm countries.

22. **Cyperus nutans** Vahl Enum. ii (1806) 363; Cke. ii, 868.

*Description*: Cke. l.c.

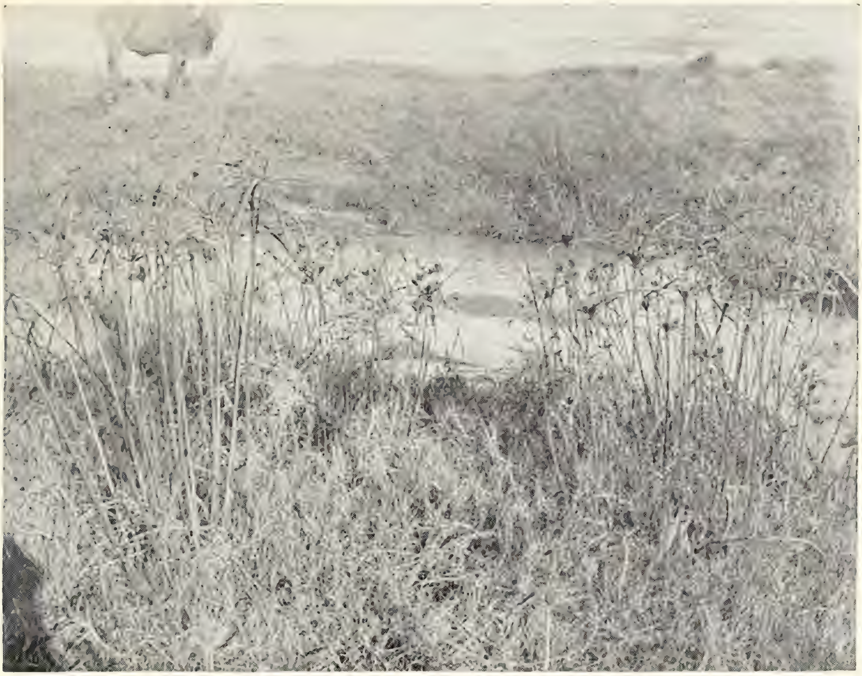
Rhachilla broadly winged by the decurrent margins of the glumes. Wings hyaline, easily detachable—the rhachilla often appearing wingless on this account.

Woodrow's Marval specimen was identified as *C. eleusinoides*.

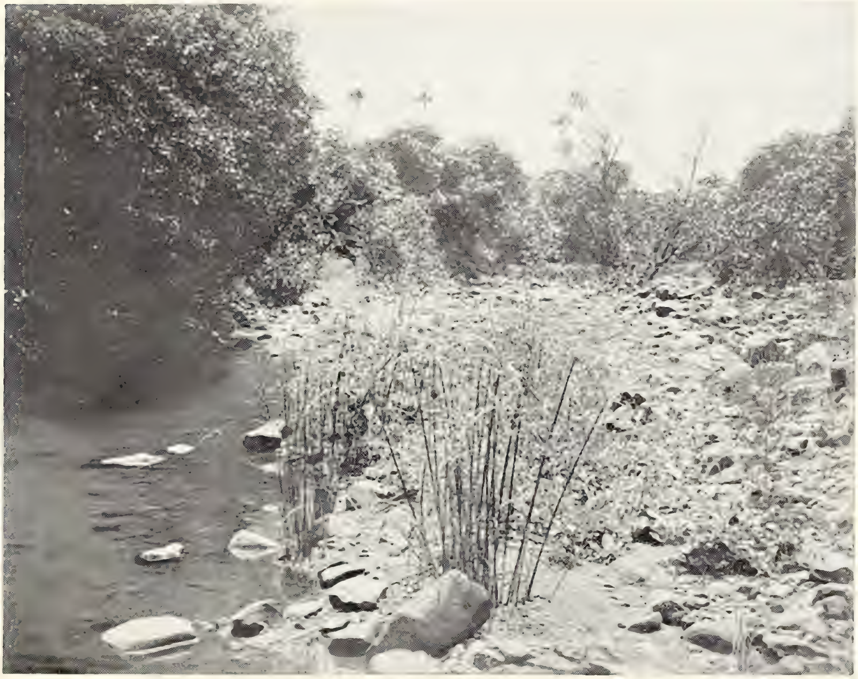
*Locality*: Without locality (Dalzell ex Cooke).—*W. Ghats*: Igatpuri (McCann 2383 !, Blatter & Hallberg 5170 !); Mahableshwar (Talbot 4541 !); Panchgani (Blatter & Hallberg B1752 ! B1753 !); Khandala (Woodrow ex Cooke, Blatter & McCann 2756 !); Castle Rock, 1,600 ft., rainfall 250 in. (Sedgwick 2759 !).—*Deccan*: Marval (Woodrow !); Lohogahad Fort, top (Blatter, Hallberg & McCann C136 !); Mawal, Poona Dist. (Blatter 3137 !).—*Konkan*: In a rocky stream-bed, south of Tulsi Lake, among rocks (McCann 1274 ! 1281 ! 1283 ! 1284 !); Borivli to Kanari Caves, in rocky stream-bed (McCann 1102 ! 1121 ! 1122 ! 1123 !); Foot of Kanari Caves (Blatter, Hallberg & McCann 28622 ! 28639 !).—*S. M. Country*: Devarayi, 1,800 ft., rainfall 90 in. (Sedgwick 4466 !).—*N. Kanara*: Sampkhand, riverbank (Sedgwick 6981 !, Hallberg & McCann C108 !); Yellapur (Talbot !); pools below Gersoppa Falls (Sedgwick 7107 !).

*Flowering & fruiting*: January 3rd, 1917 (Igatpuri); August 1917 (Castle Rock); September 15th, 1929 (Borivli to Kanari Caves); September 22nd, 1929 (south end of Tulsi Lake); October 1917 (Igatpuri); October 1918 (Devarayi, Lohogahad Fort); October 1919 (Gersoppa Falls, Sampkhand); October 1920 (Panchgani); October 10th, 1884 (Yellapur); October 16th, 1893 (Marval); October 20th, 1905 (Mahableshwar); November 1916 (Khandala); November 1918 (Borivli to Kanari Caves).

*Field notes*: Purely a monsoon species, though perennial when inhabiting the rocky and sandy beds of streams and watercourses. Commences to flower



Formation of *Cyperus eleusinoides* Kunth on the banks of Benas River, Abu Road.



Common habitat of *Cyperus corymbosus* Rottb., Borivli to Kanari Caves, Salsette Island.

*Photos by C. McCann.*

about the end of August. Dies down soon after the monsoon. This perhaps explains the supposed rarity.

The inflorescence in the young state is erect and much unlike the mature umbel which is much diffused with the ends pendulous by the weight of the seed (?). The spikelets are quite brown, becoming reddish when dry in the field and sometimes in the herbarium. Young spikelets in open situations, in the sun, are reddish. Stem 3-gonous, polished.

A species almost confined to rocky, stony and sandy localities, usually in forest. The mature plant is readily distinguished in the field by its enormous umbel (too large for the size of the plant !), drooping extremities and small glumes.

*Distribution*: More or less throughout India.—Ceylon, China, tropical Africa.

23. **Cyperus eleusinoides** Kunth Enum. ii (1837) 39; Cke. ii, 868.—*C. nutans* Vahl var. *eleusinoides* (Kunth) Haines Bot. Bihar & Orissa 898.

*Description*: Cke. l.c.

Plant reaching 134 cm., umbel 28 cm., primary ray 22 cm., bracts of primary umbel 58 cm., margins and upper one-third scabrid on both surfaces. Leaves on margins and towards the tip scabrid.

Woodrow's Talegaon to Chinchwad specimen was identified as *C. digitatus*.

*Locality*: Without locality (Dalzell !).—*Sind*: (Pinwill ex Cooke).—*Gujarat*: Banks of Watrak River, Modasa Petha (Sedgwick 1061 !); nala near the Bokh, Prantij (Sedgwick 251 !).—*Khandesh*: Amalner, Bori River (Blatter & Hallberg 1969 !); Andra, Bori River (Blatter & Hallberg 2760 !).—*W. Ghats*: Panchgani, watercourse (Blatter C155 !, Fernandez C156 !, Blatter & Hallberg B1749 !), below Tata's (Blatter 2000 !); Katraj, tank (Bhide 939 !); Pasarni Ghat, soft soil of watercourse (McCann 3038 !); Khandala (Blatter, Hallberg & McCann 3048 !, McCann 3187 ! 3188 !), tank (Blatter & McCann 3156 !).—*Deccan*: Gangapur, Nasik (Blatter & Hallberg 2340 !); Talegaon (Blatter 3133 !); Ganeshkhind Gardens, Poona (Garade !, Patwardhan !); Bopodi, near Poona (Gammie 15317 !); Talegaon to Chinchwad (Woodrow !); Mawal (Woodrow ex Cooke); Happy Valley (H.E.B.B. !); Digras, Ahmednagar Dist. (Herb. Sedgwick 6266 !).—*Konkan*: (Lambert ex Cooke).—*S. M. Country*: Devarayi, 1,800 ft., rainfall 80 in. (Sedgwick 4121 !); Dharwar, in a nala, 2,400 ft., rainfall 34 in. (Sedgwick 2881 !); Bidi, Belgaum Dist., 2,500 ft., rainfall 60 in. (Sedgwick 3022 !).

*Flowering & fruiting*: March 1917 (Khandala); March 31st, 1929 (Khandala); May 1917 (Khandala); June 1905 (Ganeshkhind); July 1916 (Khandala); July 1918 (Devarayi); August 1911 (Digras); August 1914 (Prantij); August 10th, 1905 (Ganeshkhind); August 13th, 1902 (Bopodi); August 20th, 1903 (Ganeshkhind); September (Talegaon); September 1915 (Watrak River); September 1917 (Gangapur, Dharwar, Bidi); September 3rd, 1930 (Pasarni Ghat); September 5th, 1929 (Panchgani); September 19th, 1902 (Katraj, tank); September 27th, 1895 (Talegaon to Chinchwad); October 1908 (Panchgani); November 23rd, 1929 (Panchgani); December 1916 (Amalner, Amda); December 21st, 1907 (Happy Valley).

*Field notes*: A monsoon plant on the whole, but may be found at any time of the year in marshes and on the banks of rivers. Always to be found partially in or near water along the banks of rivers, streams and tanks. It is best in flower just before the rains give over and immediately after.

A good species easily recognizable both in the field and in the herbarium. The leaves and stems are highly polished.

The distribution is rather curious. Though a very common plant in the Presidency it apparently prefers the drier portions, not being found in N. Kanara. When in very dry situations it dies down very rapidly after the monsoon; this may possibly explain its absence from Cutch and Kathiawar.

In Rajputana (Abu Road) we have observed this species growing on the banks of the Benas River in close formation covering a considerable area associated with the Northern form of *Pycreus globosus* Nees. Here it attained a height of a little over 60 cm. with ridged culms.

In Panchgani specimens were found growing in a water hole (an old tank built in) deeper than the height of a man (in some places). Here these plants reached extraordinary proportions with regard to height, size of umbel and length of bracts.

*Distribution*: Sind, Gujarat, Khandesh, Deccan, Konkan, S. M. Country, and all E. and Central districts of the Madras Pres., Nilgiris, Pulney and Travancore Hills, Punjab, Upper Gangetic Plain, Ranchi, Naga Hills.—Ceylon, tropical and warmer parts of Asia, Africa and Australia.

24. **Cyperus pilosus** Vahl Enum. ii, 354.—*C. marginellus* Nees in Wight Contrib. 83.—Synonyms in F.B.I. vi, 609.

*Description*: Glabrous, except the rhachis of spikes. Stolons scarcely 1.25 mm. diam., with distant nodes and scales 6-8 mm. long, easily overlooked when young as roots, but afterwards thickening somewhat into a wiry rhizome. Stems at top acutely triquetrous, from 0.9 m. with umbel 40 cm. across, to 10 cm. with umbel reduced to 1 head. Secondary umbel closely corymbed. Leaves often $\frac{3}{4}$ length of stem, 5-8 mm. broad; bracts overtopping umbel, leaf-like. Rhachis of spikes in most examples definitely pilose, often only more or less scabrous subpilose, in the form *marginellus* microscopically glabrous. Spikelets (commonly) 10 by 2 mm., linear, 10-20-flowered, compressed, reddish or brown or straw-coloured, close or remote, when ripe spreading at right angles; rhacheola obscurely (or not) winged. Glumes ovate, muticous, scarcely keeled, 3-7-nerved on back, ultimately loosely imbricated. Stamens 3; anthers linear-oblong, muticous. Nut acutely trigonous, ellipsoid, apiculate, 3/5 length of the glume, black; style shorter than nut; branches linear, moderately exserted.

We see no good line of demarcation between this species and *C. procerus* Rottb. The rhachis of the inflorescence is pilose to varying degrees. In this matter we find that we are in agreement with the views of Boeckeler. We certainly cannot separate the two species.

Leaves and bracts scabrid throughout on both surfaces. The margins leaving a sharp cutting edge when the finger is rubbed from tip to base. Margins of glumes distinctly hyaline.

*Locality*: *W. Ghats*: Panchgani, in a marsh near a stream (McCann 3172 ! 3194 !, Fernandez C200 ! C201 ! C202 ! C206 !).—*Konkan*: Foot of hill W. of Mulland, in a stream (McCann 1632 ! 1633 !); Bhandup (Blatter & McCann 2416 !); near Vehar Lake (McCann 649 ! 650 ! 1285 ! 1286 !); Vetora (Sabnis 33763 !).—*S. M. Country*: Devarayi, 1,800 ft., rainfall 90 in. (Sedgwick 4483 !).—*N. Kanara*: (Bell 4447 !); marshes near Nagagati, 1,800 ft., rainfall 90 in. (Sedgwick 2915 !); Sampkhand (Hallberg & McCann C105 ! C116 !).

*Flowering & fruiting*: April 27th, 1930 (Hills W. of Mulland); June 1917 (Bhandup); July 7th, 1929 (Vehar Lake); September 19th, 1930 (Panchgani); September 22nd, 1929 (Vehar Lake); October 1918 (Kanara, Devarayi); November 23rd, 1929 (Panchgani).

*Field notes*: A monsoon species to a certain extent; but it may be found at any time of the year on the banks of streams or otherwise near water. The stems are sharply triquetrous. The inflorescence is very characteristic being frequently straw-coloured or reddish. The rays and spikelets are very stiff. The long creeping stolons are covered at intervals with bluish purple scales.

*Distribution*: Throughout India from sea-level to 5,000 ft.—Tropical Asia, Africa and Australia.

**Var. obliqua** Clarke in Journ. Linn. Soc. xxi, 151.—*C. obliquus* Nees in Wight Contrib. 86.

*Description*: Spikelets with fewer, sometimes only 5-6 flowers, often pale and very far apart.

*Locality*: *N. Kanara*: Yellapur (Talbot 987 !).

*Flowering & fruiting*: September 15th, 1884 (Yellapur).

*Distribution*: Widely scattered in India.—Java.

25. **Cyperus procerus** Rottb. Descrip. *et* Ic. (1773) 29, t. 5, fig. 3; Cke. ii, 867.—Synonyms in F.B.I. vi, 610.

*Description*: Cke. l.c.

*Locality*: *Goa*: (Woodrow ex Cooke).—*S. M. Country*: Dastikop, small tank, 1,800 ft., 35 in. rainfall (Sedgwick 3790 !); Shiggaon, 2,000 ft., rainfall 33 in. (Sedgwick 2129 !); Devikop, 2,000 ft., rainfall 45 in. (Sedgwick 2972 !).

*Distribution*: More or less throughout India.—Ceylon, Tonkin, Java.

26. **Cyperus malaccensis** Lam. Illustr. i (1791) 146; Cke. ii, 869.—*C. Pangorii* Roxb. Hort. Beng. (1814) 6.—Synonyms in F.B.I. vi, 608.

*Description*: Cke. ii, 869.

The Keti specimen D719 was determined as *Cyperus tegetum* Roxb. in the Fl. Indus Delta by B. N. Vakil.

*Locality*: *Sind*: (Pinwill ex Cooke); Keti (Blatter & McCann D719 !).—*Konkan*: Kalyan (Woodrow ex Cooke).—*Goa*: (Woodrow ex Cooke).—*N. Kanara*: Mirjan (Sedgwick 6844 !, Hallberg & McCann C192 !).

*Flowering & fruiting*: October 1919 (Mirjan); October 1922 (Keti).

*Field notes*: A species of salt marshes where the marshes are not too salt—generally in the mouths of rivers under tidal influence.

*Uses*: 'A large glabrous sedge, useful for binding and protecting muddy river banks' (Prain, Fl. Sundribuns, Rec. Bot. Sur. Ind. vol. ii, p. 351).

*Distribution*: Sind, Konkan, N. Kanara, Quilon, Bengal to Singapore, Circars ?—Japan, China, Borneo, Australia, Persia.

27. **Cyperus bulbosus** Vahl Enum. ii (1806) 342; Cke. ii, 871.—*C. jeminicus* Retz. Obs. iv (1786) 11.—Synonyms in F.B.I. vi, 611.

*Description*: Cke. l.c.

The Mirpur Sakro and Gholam specimens were determined as *C. Haspan* in the Fl. Indus Delta by B. N. Vakil. *C. Haspan* is a heavy rainfall species and is not likely to occur in Sind.

*Locality*: Sandy shores near the sea (Dalzell & Gibson ex Cooke).—*Sind*: (Herb. St. X.C. 1971 !); Mirpur Sakro (Blatter & McCann D713 ! D714 !); Gholam (Blatter & McCann D715 ! D716 ! D717 !); Hyderabad (Woodrow ex Cooke); Jamadar ka Landa, near Karachi (Stocks ex Cooke).—*Cutch*: (Blatter ex J.B.N.H.S.).—*Gujarat*: Ahmedabad, fields (Sedgwick !); Vastrapur, near Ahmedabad (Saxton 1771 !).—*Deccan*: Kirkee, Mr. Gammie's compound (Garade 4 sheets 572 !).—*Konkan*: Sewri, Bombay Isl. (Blatter & McCann 1851 !); Victoria Gardens (Blatter & McCann 2392 !); Bandra, from pasture on side of Danda Rd. (Vakil C170 !).—*N. Kanara*: Karwar, sandy shore (Sedgwick 5050 !, Talbot 1262 ! 1537 !).

*Flowering & fruiting*: June 25th and 30th, 1885 (Karwar); July 1917 (Victoria Gardens Sewri); July 1919 (Bandra); July 21st, 1902 (Kirkee); July 27th, 1919 (Vastrapur); August 1914 (Ahmedabad); October 1922 (Gholam, Mirpur Sakro).

*Uses*: *Cyperus bulbosus*, called Theg (Ahmedabad) or Bid (Viramgam) 'grows in a river near Viramgam. Its bulbs are dried and powdered and used with jowari, bajri or wheat flour. It is not very nutritious, therefore it is mixed with the above flours. It grows wild and its effects are that people who use it as food become night blind.' Gammie Rec. Bot. Surv. of India, ii, 193.

*Distribution*: Sind, Baluchistan, Rajputana.—Ceylon, tropical Africa and Australia.

28. **Cyperus articulatus** Linn. Sp. Pl. (1753) 66; C. B. Clarke in Hook. f. F.B.I. vi, 611.—*C. nudus* Roxb. Fl. Ind. i (1832) 187 (*non* 209, *neque* H.B. & K.).

*Description*: Glabrous. Stolons 3-4 mm. diam., clothed by ovate-lanceolate striate brown-black scales 17 mm. long. Stems 0.9-1.8 m., often 5-10 cm. apart on the thick woody rhizome, at top 3-4 mm. diam., terete or scarcely trigonous, when dry usually with false nodes 13 mm. apart; upper sheaths usually terminated by a subspathaceous lanceolate coloured limb, rarely by a small green leaf. Leaves hardly any. Umbel compound of many spikes. Umbel-rays often 10, up to 5-15 cm.; bracts very short, 8-17 mm., ovate, acute, scale-like, striate, subturgid at base hardly keeled, concave, margins not reflexed. Spikes linear, many-flowered. Spikelets 5-15 together, shortly spicate, 8-38 by 2 mm., 12-50-flowered, straw-coloured, afterwards dusky. Glumes even in fruit imbricate, ovate, obtuse, concave, scarcely keeled, obscurely 3-5-nerved on back; wings of rhachilla oblong or elliptic, scarious, ultimately deciduous. Stamens 3; anthers linear-oblong, muticous. Nut trigonous, oblong-ellipsoid, acute at either end, 3/5 length of glume, black; style shorter than nut; branches linear, shortly exsert.

Stems hollow but traversed transversely by thin white septa.

*Locality*: *Gujarat*: Ahmedabad, riverside (Sedgwick 1018 !).—*W. Ghats*: Khandala (McCann 3195 !).—*Konkan*: Varol tank, Bhivandi, near Kalyan (McCann 1682 ! 1683 ! 1720 ! 1721 !).—*S. M. Country*: Mishrikot, 1,800 ft., rainfall 30 in. (Sedgwick 3179 !); Devikop (Talbot 1062 !); Kilgerry, Dharwar Dist. (Talbot 2612 !); Dastikop (Talbot 1062 !).—*N. Kanara*: Mundgod (Talbot !).

*Flowering & fruiting*: February 1884 (Mundgod); April 1917 (Khandala); May 1915 (Ahmedabad); September 15th, 1891 (Kilgerry); October 26th, 1930 (Varol Tank); October 29th, 1884 (Dastikop); October 30th, 1884 (Devikop); December 1917 (Mishrikot).

*Field notes*: A plant of the banks of rivers and lakes. The Varol specimens were growing mixed in the same clump with *C. tegetum*, but were easily distinguished from that plant by the difference of the stems and the inflorescence. The spikes are pale straw-coloured (in *C. articulatus*) the older ones slightly tinged with brown. The entire inflorescence is very weak and all the rays hanging down. The presence of septa is not always apparent in herbarium material.

*Distribution*: Bengal to Ceylon.—Tropical and warm regions of both hemispheres.

29. **Cyperus corymbosus** Rottb. Descr. *et* Ic. (1773) 43, t. 7, fig. 4; C. B. Clarke in Journ. Linn. Soc. xxi, 158, and in Hook. f. F.B.I. vi, 612; Cke. ii, 870.—*C. diphyllus* Retz. Obs. v (1789) 11 (*non* Benth.); Boeck. in Linnaea xxxvi (1870) 272.—*C. Koenigii* Vahl Enum. ii (1806) 302; Kunth Enum. ii, 54.—*C. monophyllus* Vahl l.c. ii, 352 (*fide* Nees).—*C. seminudus* Roxb. Fl. Ind. i (1832) 187; Nees in Wight Contrib. 80; Kunth l.c. 55 (*non* Moritz.).—*C. enodis* Boeck. l.c. 271.—*Papyrus Pangorii* Nees l.c. 88 (*partim*).—*C. articulatus* Ridley in Trans. Linn. Soc. ser. 2, Bot. ii, 141 (*partim*).—*C. corymbosus* var. *Pangorei* C. B. Clarke l.c. 292, 159.—*C. Pangorei* Rottb. l.c. 31, t. 7, fig. 3.—*C. tegetiformis* Roxb. Hort. Beng. (1814) 6; Arn. in Wight Contrib. 89 (*in nota*); C. B. Clarke l.c.—*C. nudus* Roxb. Fl. Ind. i (1832) 209 (*non* 187 *neque* H.B.K.).—*C. bengalensis* C. Spreng Neue Entdeck. iii, 101.—*C. Gula-Methi* Roem. & Schult. Syst. ii, Mant. 125.—*C. tegetum* Roxb. Fl. Ind. i (1832) 208; C. B. Clarke l.c. (*partim*).—*C. dehiscens* Nees in Linnaea ix, 286; Kunth Enum. ii, 56 (*excl. syn.* Roxb.).—*Papyrus dehiscens* Nees in Wight Contrib. 89.—*P. Pangorei* Nees l.c. 88.—*P. corymbosus* Nees l.c. 89.

We have united *C. tegetum* Roxb. and *C. tegetiformis* with *C. corymbosus* Rottb. for the reasons given below.

*Description*: Stems bluntly or sharply trigonous above, spongy below, septa not or hardly visible when dry, up to 1.8 m. high. Rhizome creeping, stout, woody. Leaves reduced to sheaths or sometimes with a blade up to 15 cm. long. Bracts 3-5, linear-ensiform, shorter or longer than the inflorescence, between 7 and 65 cm. long and 5-12 mm. wide. Umbel compound; primary rays 6-15, slender, up to 15 cm. long; secondary rays terminated by spikes or corymbs of 4-16 spikelets; spikelets linear, 10-37 mm. long, glumes ovate-oblong when unfolded, obtuse or subacute, 2.5 mm. long, straw-coloured or pale reddish brown or red-brown, rhachilla of spikelets distinctly 2-winged opposite the seeds, narrow or wide, usually pale or blood red in fruit. Nut narrowly elliptic-oblong, trigonous, 1.6 mm. long, black.

We have spent much time both in the field and in the herbarium trying to find a character to separate these three species but have failed completely. Beside studying the fresh material we have also examined the material determined by C. B. Clarke in the Calcutta Herbarium.

Much stress has been laid on the length of the bracts by some authors but this is a very unreliable character in most *Cyperaceae*. Of the three 'species' *C. tegetum* is supposed to have the longest bracts, while *C. tegetiformis* rarely has the bracts half as long as the umbel, and in *C. corymbosus* the bracts are said to be rarely as long as the umbel. The term 'rarely' indicates that at times the bracts may be as long as the umbel, though these may be 'exceptional cases'. On this account some authors regard *C. tegetiformis* as a variety of or conspecific with *C. corymbosus*, and rightly so.

Cooke in the Flora of the Bomb. Pres. has the following remark under *C. tegetiformis*: 'Woodrow gives Kalyan as the habitat of the plant, but I have seen no specimen from the Bombay Presidency; there are none in Herb. Kew. It is possible that the plant collected by Woodrow may have been *C. corymbosus*, which is scarcely separable from *C. tegetiformis* and which is also reported from Kalyan.' Cooke has not seen either *C. corymbosus* or *C. tegetiformis*.

Sedgwick, in *The Journal of the Bombay Natural History Society*, xxv, 695, had added the following note under *C. tegetiformis*: 'Both *C. tegetiformis* and *C. corymbosus*, Rottb., are given by Cooke as occurring at Kalyan *fide* Woodrow). These two species are very imperfectly characterized, and are very probably forms of one species. Cooke doubts whether they both occur. I have placed the St. Xavier's College specimens in *tegetiformis* as the spikelets are pale, whereas the spikelets of *corymbosus* should be red. The bracts, however, are more than half the inflorescence.'

Here again we have a character, viz. colour, which is unreliable not only in dried but also in fresh specimens.

Haines, in the Botany of Bihar and Orissa, pt. v, p. 899, makes the following remark under *C. tegetiformis*: 'There is only one specimen from our area (Gaya) which has been named in the Cal. Herb. and that appears to me doubtful and is possibly *C. corymbosus*. The bracts slightly exceed the umbel and the erect spikelets are very young. Glumes ·11 in. long, back with 5 slender nerves, anthers 3 minutely apiculate, wings of rhachilla very obscure, nut undeveloped. Most of the specimens named by Clarke are from Lower and Eastern Bengal. I suspect that the length of the involucral bracts is not a good character, especially in inflorescence of different stages of growth.'

Under the species *C. corymbosus*, l.c. Haines writes: 'I have seen no ripe nuts, and suspect that some specimens ascribed to this species are young states of others and that there is no specific difference between this and *tegetiformis*. Rhizome creeping, clothed with dark brown scales and hardening into rhizomes. The new shoots are said to arise on these at some distance from one another as also in the case of *tegetiformis*, whereas in *C. tegetum* there are said to be no stolons and thus the lateral shoots arise from the base of the older ones. Herbarium material is insufficient to check these characters.'

Again, with reference to *C. tegetum*, l.c. Haines remarks: 'Rhizomes stout and in some of my specimens culms quite 1 in. apart. Sheaths much inflated when old. Leaves above the sheath 0 or 3-9 in. long. Inflorescence with long foliaceous bracts often one and a half times its length, about ·2-·3 in. wide, margins scaberulous, midrib strong. Branches of umbel 1-10 in. long suddenly contracted at the corymbs of spikes, branches and peduncles of spikes with short lanceolate finely or setaceously acuminate bracts as well as a short truncate sheath at their base. Glumes sometimes only ·06 in. long in flower. Wings of rachilla about ·04-·05 in. long, as long as the ovary and usually green in flower, ultimately red or brown. Stamens 3. Style rather persistent about ·04 in., leaving no base on falling, stigmas 3 long and slender, often ·12 in. long.

'This is a good species for observing that the wings of the rachilla form no part of the glumes (as stated to be the case by Cooke); the glumes very clearly embrace the wings and can be removed over the wings.'

Another character stressed by authors is in the wings of the rhachilla, which are supposed to be dark brown in *C. tegetum*. This is, however, the case with all the so-called species if the inflorescence is allowed to mature. We have in our collection specimens of the three 'species' with the wings of the rhachilla varying in tint from hyaline to deep brown and we have seen material in other collections exhibiting the same degree of variation. When the spikes are immature the wing of the rhachilla is hyaline, becoming dark brown as the spikes get older. Haines remarks that he has seen no ripe nuts of *C. corymbosus*, and that in the case of the one specimen of *tegetiformis* from the area the nut was undeveloped.

Though the bracts and the rhachilla are much used as a means of identifying these three 'species' we must admit that they are unreliable characters. Comparing the descriptions of the spikelets, glumes and nuts we find that there are barely any differences worthy of specific rank.

The most essential characters are thus either the same or overlapping. In the case of *tegetiformis* there are said to be 5-9 nerves to the glume but this is a very variable character in all three 'species', *Locality*: *Sind*: (Pinwill ex Cooke).—*Gujarat*: Marshy ground, the Watrak riverbanks, Sabarmati river-bed, the Bokh (Saxton & Sedgwick, Pl. N. Guj. R.B.S.I. vi, 305).—*W. Ghats*: Igatpuri (Blatter & Hallberg 3211 !, McCann 2386 !); Panchgani, stream below Dalkeith (McCann 3492 !); Bairawadi, foot of Purandhar (Blatter & McCann 5578 !); Khandala, on sandy soil (McCann C117 !, Blatter, Hallberg & McCann 2420 ! 3049 !, Blatter 1856 !); Khandala to Karjat (Blatter & Hallberg 3171 !); Lonavla (Garade ex Cooke). —*Deccan*: Poona (Talbot !); Kirkee (Talbot !); Gangapur, Nasik (Blatter & Hallberg 2821 !).—*Konkan*: (Cooke); Thana (Blatter & McCann 8727 !); Trombay (Blatter & McCann 33855 !); Borivli to Kanari Caves, on sand in bed of watercourse (McCann 1103 !); in a marsh among the hills W. of Vickroli (McCann 1021 !); Mulland, in a stream (McCann 901 ! 907 ! 908 !); foot of hills W. of Mulland (McCann 906 !); hills W. of Tulsi Lake, in a stream (McCann 357a ! 357b ! 357c ! 810 !); Kalyan (Woodrow ex Cooke).—*S. M. Country*: Devarayi, 1,800 ft. (Sedgwick 4119 !); Havasbhavi, 2,000 ft., rainfall 35 in. (Sedgwick 2159 !).—*N. Kanara*: Gersoppa Falls (Hallberg & McCann C118 !, Sedgwick 7126 !); Kalanuddi, Supa, 1,800 ft., rainfall 100 in. (Sedgwick 4863 !); Haliyal (Talbot 2219 !); Kilgerry (Talbot 2613 !).

*Flowering & fruiting*: January 5th, 1890 (Haliyal); March 1917 (Khandala to Karjat); March 11th, 1929 (Hills W. of Mulland); July 1918 (Devarayi); August 1914 (Prantij); August 11th, 1929 (Mulland; Hills W. of Mulland); August 25th, 1929 (Hills W. of Vickroli); September 1915 (Watrak River); September 1917 (Gangapur); September 15th, 1890 (Kilgerry); September 15th, 1929 (Borivli to Kanari Caves); September 15th, 1905 (Kirkee); October 1890 (Poona); October 1917 (Igatpuri); October 1919 (Gersoppa Falls); November 1918 (Supa); December 1914 (Watrak River); December 1916 (Havasbhavi).

*Field notes*: A tall perennial species with thick hard, black, creeping rhizomes, the anterior end of which usually sends up few short leaves before the appearance of the culm. Wherever there is water this species lasts throughout the year. The culms that flower during the monsoon loose the inflorescence with the approach of the dry weather and then die down, but if there is plenty of water these old culms remain and new ones are also developed but these hot weather culms do not reach the same size as those produced during the monsoon, nor are the inflorescences so large.

The plants developed in soft clayey soil are generally the most vigorous. The rhizomes are usually deep rooted and are difficult to extract.

The Floras give leaves short or 0 for this section. In our experience this is not the case. In specimens with mature rhizomes a few short leaves are often developed, but usually longer than the measurements given in the Floras. The leaves are developed on the new shoots of the mature rhizomes long before the inflorescence-bearing stem appears. When the culm appears the leaves fall away leaving a sheath embracing it with a short prolongation—the leaf of the Floras.

Seedlings have long fairly broad leaves (sometimes exceeding 45 cm. and more). These leaves are generally longer than those developed directly from new shoots of the rhizome. Another point worthy of note is that the inflorescence-bearing culms endure for a long time in a green state, long after the spikelets have fallen, and so do the bracts—but the culms remain longer.

The wing of the rhachilla is at first quite hyaline and gradually changes to a dark brown. In herbarium material the colour of the rhachilla depends much on the time when the inflorescence was collected and how far advanced it is.

*Uses*: This plant is used for the manufacture of mats.

*Distribution*: Throughout India.—Ceylon, China, Japan, most of tropical Asia, Africa and America, Madagascar.

30. **Cyperus macer** C. B. Clarke in Journ. Linn. Soc. xxi, 160; in Hook. f. F.B.I. vi, 613.

*Description*: Glabrous. Stems long, slender, 60-90 cm., at top very slender triquetrous. Leaves few, short, inconspicuous, uppermost 10-15 (rarely 20-25) cm. long, erect, narrow. Umbel loose, irregular, slender. Umbel-rays 3-6, slender, 5-10 cm. long, sometimes again divided; bracts 13-50 mm., leaf-like. Spikelets 8-16-flowered, linear, 13 by 1.5 mm.; wings of rhachilla narrow-oblong, hyaline, disappearing. Glumes somewhat remote, in fruit not imbricate,

Formations of *Cyperus macer* (mid-stream) at Lingmala, near Mahableshwar.

Common habitat of *Cyperus exaltatus* Retz. in a marsh at Mulland, Salsette Island.

*Photos by C. McCann.*

ovate-oblong, obtuse, 3-5-nerved, back green, sides brown, nerveless. Stamens 3; anthers linear-oblong, muticous. Nut trigonous, obovoid, ashy black, $\frac{1}{2}$-$\frac{3}{5}$ length of glume; style shorter than nut; branches linear, long.

*Locality*: *Gujarat*: Under Gorair Bridge, Chitrasani to Sarotra, in sandy bed of a stream, at water's edge (McCann 1375 ! 1375a !); Karad to Islampur Road (Chibber !).—*Khandesh*: Wadli, Tapti bank (Blatter & Hallberg 5491 !); Bor, Tapti River (Blatter & Hallberg 1929 ! 3014 !); Thalner, Tapti bank (Blatter & Hallberg 3021 !); N.-E. of Bhusawal, in Tapti bed (Blatter & Hallberg 2759 !).—*W. Ghats*: Panchgani, 2½ mm. W. (Blatter & Hallberg B1751 !, Fernandez C189 !); Mahableshwar in a stream on hillside, 4,500 ft., rainfall 270 in. (Sedgwick 4551 !); Lingmala, common in river (McCann 3361 ! 3382 ! 3383 !); foot of Fitzgerald Ghat, river-bed (Blatter C216 !).—*N. Kanara*: Sampkhand, in river (Sedgwick 6972 !).

*Flowering & fruiting*: January 3rd, 1917 (Wadli); September 24th and 27th, 1930 (Lingmala); October 1919 (Sampkhand); October 1920 (Panchgani); October 24th, 1929 (Gorair Bridge); November 1918 (Mahableshwar); November 28th, 1902 (Karad to Islampur Road); December 1916 (Bor, Thalner).

*Field notes*: We have several records of this species from the Presidency but are of opinion that this species was overlooked for small forms of *C. corymbosus*, and included under that species. In the field it is easily distinguished from that species, but herbarium material is somewhat difficult to determine.

It is a plant of rocky beds of rivers and also of pebbles where it forms dense mats with its roots. The Yenna River is full of this species. The dense mats of roots and rhizomes are quite different from those of *C. corymbosus*, in which case the rhizomes are very thick.

*Distribution*: Pegu, Chittagong, Central India, Gujarat, Khandesh, W. Ghats, Deccan, N. Kanara.

31. **Cyperus rotundus** Linn. Sp. Pl. (1753) 45; Cke. ii, 871.—*C. hexastachyus* Rottb. Descr. *et* Ic. (1773) 28, t. 14, fig. 2.—*C. leptostachyus* Griff. Itin. Notes 321 (*non* Nees).—*C. tenuiflorus* Royle Ill. 412 (*non* Rottb.).—*C. Fenzelianus* Steud. Syn. Cyp. 33.—*C. pallescens* Boiss. Fl. Or. v, 375 (*non* Desf.).—*C. subcapitatus* C. B. Clarke in Hook. f. F.B.I. vi, 616.—*C. tuberosus* Rottb. l.c. 28, t. 7, fig. 1.—For synonyms see C. B. Clarke in F.B.I. l.c.

We follow Fischer (Fl. Madras, 1641) in uniting *C. Fenzelianus*, *C. subcapitatus*, and *C. tuberosus* with *C. rotundus*. Here we have to deal only with *C. tuberosus*. Cooke already (l.c.) remarks with regard to *C. tuberosus*: 'Not distinguishable from *Cyperus rotundus* by any good characters and it might well be united with it'.

*Description*: Tubers not zoned. Stems subsolitary, trigonous, 0.1-1.2 m. high. Leaves flat, flaccid, shorter or longer, narrow, often numerous; bracts usually 3, shorter or more often longer than the inflorescence, up to 60 cm. long. Umbel simple or compound; rays few to many, up to 15 cm. long; secondary, if present, few, ending in 4-8 approximate, spreading spikelets; spikelets linear to lanceolate, 7.5-35 mm. long; glumes imbricate, 2.5 mm. long, plicate, ovate when expanded, obtuse or acute, keel 5-7-nerved, pale straw or brown, or chestnut, sometimes with a reddish tinge. Nut trigonous, broadly obovoid, greyish black.

The Poona specimen collected by Bhagwat is an excellent specimen with bulbils and bulbous bases to the stems but no proper inflorescence.

Possess both stolons and rhizomes (Sedgwick).

*Locality*: Without locality (Dalzell !).—*Sind*: (H.E.B.B. !, Bhola Puran 25 ex Cooke); Mirpur Sakro (Blatter & McCann D720-D726 !); Bohara (Blatter & McCann D727 !); Gholam (Blatter & McCann D728 !), in a garden (Blatter & McCann D729 !); Kullan Kote Lake (Blatter & McCann D730 !); Tatta (Blatter & McCann D731 ! D732 !); Bughar, on the Indus (Blatter & McCann D733 ! D734 !); Chunar (Blatter & McCann D735 !); Bhubak (Woodrow ex Cooke).—*Cutch*: (Blatter 3774 !); Pacham Isl., Rann of Cutch (Blatter 1973 !).—*Gujarat*: Surat (H.E.B.B. !, Gammie 16440 !, Woodrow !); Empress Gardens, Ahmedabad (Sedgwick 1049 !); Ahmedabad (Sedgwick !, Blatter 2166 !, Cooper !).—*Khandesh*: Bori River (Blatter & Hallberg 2750 !); Bor, Tapti River (Blatter & Hallberg 1860 ! 3011 ! 5132 !); Taner, Tapti bank (Blatter & Hallberg 5171 !); Dhulia, Thikhi tank (Chibber !).—*W. Ghats*: Lonavla (Woodrow ex Cooke, H.E.B.B. !); Khandala (Blatter, Hallberg &

McCann 3045 ! 3066 !); Purandhar (Blatter & McCann 5569 ! C217 !); Panchgani (McCann 2983 ! 3021 !); Matheran (Woodrow ex Cooke).—*Deccan*: Ahmednagar, 1,800 ft., rainfall 24 in. (Herb. Sedgwick & Bell 6337 !); Poona (Woodrow ex Cooke, Jacquemont 382 ex Cooke, Bhagwat !); College Farm (Ezekiel !); Kirkee, Mr. Gammie's compound (Garade 552 !); Parvati tank (H.E.B.B. !); Deolali (Blatter & Hallberg C143 ! 2836 !).—*Konkan*: (Law ex Cooke); Bombay (McCann 469 ! 470 ! 471 ! 472 ! 714 ! 715 ! 716 ! 774 !), St. Xavier's College compound (McCann 2414 ! 2432 ! 2447 !), Victoria Gardens (Blatter & McCann 2390 ! 2393 ! 2413 !); Parel (Blatter & McCann 3074 !); Sion (Blatter & McCann 1988 ! 2374 !); Bhandup (Blatter, Hallberg & McCann 2412 !); Bhandup to Vehar Lake (McCann 644 !); E. shore of Vehar Lake (McCann 636 !); Bandra, Danda Road (Vakil C144 !); Mulland, in a marsh W. of village (McCann 892 ! 899 !); Mulgaon (Blatter & McCann 2443 !); Thana (Woodrow); Sangli, river bank (Blatter C142 !); very common throughout the Islands of Bombay and Salsette (McCann !).—*S. M. Country*: Margins of tank, Kalghatgi, 2,000 ft., rainfall 30 in. (Sedgwick 3667 !); Dharwar, rice fields, 2,400 ft., rainfall 34 in. (Sedgwick 6189 !); Yelvigi, 2,000 ft., rainfall 30 in. (Sedgwick 1914 !); Hubli (H.E.B.B. !); Kilgerry (Talbot 2625 !).

*Flowering & fruiting*: January 15th, 1890 (Kilgerry); January 22nd, 1925 (Sangli); June 1917 (Bombay, Bhandup, Sion); June 1919 (Bandra); June 24th, 1929 (Bombay); June 28th, 1917 (Poona); July 1914 (Ahmedabad); July 1916 (Parel); July 1917 (Mulgaon, Bombay, Khandala); July 7th, 1929 (Vehar Lake, Bhandup to Vehar Lake); July 21st, 1902 (Kirkee); July 27th, 1929 (Bombay); July 28th, 1920 (Parvati); August 1915 (Ahmedabad); August 1916 (Khandala); August 1919 (Dharwar); August 7th, 1924 (Bombay); August 11th, 1929 (Mulland); August 27th and 31st, 1930 (Panchgani); September 1917 (Devlali); September 1919 (Ahmednagar); September 2nd, 1895 (Lonavla); September 27th, 1913 (Ahmedabad); October 16th, 1906 (Hubli); October 29th, 1903 (Surat); November 1905 (Poona); November 1916 (Sion); December 1907 (Pacham Isl.); December 1916 (Taner, Bor, Bori River, Yelvigi); December 17th, 1892 (Surat); December 28th, 1907 (Dhulia).

*Field notes*: 'The commonest and worst weed in Gujarat' (Sedgwick).

Sedgwick rightly remarks that this is the commonest and worst weed, but not only in Gujarat. It flourishes the whole year where there is sufficient moisture, but it is most striking after the break of the rains. It is more essentially a monsoon plant. It fills up every available bit of ground whether stony, sandy or marshy.

On sandy and stony soil the plant attains its most characteristic form while in marshes it becomes much larger, with sharply 3-gonous stems and a large pendulous umbel. The leaves frequently persist throughout the year in spite of dry conditions (especially so on lawns). It is an exceptionally fast growing species. When the inflorescence is detached it soon puts forth a new one. It is a most variable plant.

Along the railway lines it is very abundant in the Islands of Bombay and Salsette. In these places we have noticed this species pass over the country in two distinct waves. With the break of the monsoon it springs up everywhere and is soon after in full bloom. This is the first wave which ends about the end of July when all the spikelets turn almost black and fall away. About a month or so later a second wave appears but this is not as strong as the first and the plants do not appear so well developed. We presume the second wave is the result of the seed of the first wave; but this we would not like to say for certain, as it may also be due to a second crop of individuals from the new shoots that are formed by the stolons.

*Distribution*: All warm countries.

32. **Cyperus esculentus** Linn. Sp. Pl. (1753) 67.

*Description*: An erect glabrous herb up to 50 cm. in height with slender subterranean stolons more or less covered with acute rather hard strongly veined scales and ending in ovoid to cylindrical edible tubers up to 2 cm. in length. Stem-base pale brown, leaf-sheaths not fibrous, stems triquetrous, smooth, finely striated. Leaf-blades shorter than the stems, linear and gradually tapering in the upper part to a fine acuminate apex, 3-5 mm. in width. Inflorescence primarily umbellate, of sessile and peduncled spikes the rays up to 7.5 cm. in length, primary bracts about 4, unequal, leaf-like, the longest up to 10 cm. or more. Spikes rarely exceeding 2.5 cm. and most often simple, the first glumes (or secondary bracts) of the lowest spikelets sometimes with a short narrow leafy blade. Spikelets linear, about 1.3 cm. long or shorter, 1.5 mm. wide; rhachis slender with narrow hyaline wings. The 2 lowest glumes of each spikelet linear-lanceolate, acuminate. Flowering glumes boat-shaped, with a rounded or slightly emarginate apex, 3 mm. long, 1.5 mm. in breadth when spread out, 3 lateral nerves on each side of the keel nerve. Stamens 3. Style divided to below the middle, with its 3 branches 2 mm. long. Nut obovoid-ellipsoid in outline with 3 sharp angles, 1.5 mm. long.

*Locality*: *Gujarat*: Edge of the tank, Talod, August 1914; never seen again, one plant only a viviparous form (Saxton & Sedgwick Pl. N. Guj. R.B.S.I. vi, 806).

This plant is now firmly established on both sides of the Colaba Road, Bombay, when it crosses over the Bombay, Baroda and Central India Railway. There also the plants are often viviparous (Saxton & Sedgwick l.c.).

*Distribution*: Upper Gangetic Plain, from the Ganges Plain to the Nilgiris and Anamalais.—In nearly all warm countries, especially in America.

33. **Cyperus stoloniferus** Retz. Obs. iv, 10; Nees in Wight Contrib. 81; Fischer Fl. Madras 1641.—For synonyms see C. B. Clarke in Hook. f. F.B.I. vi, 615.

*Description*: Stolons long, hardening into a long-creeping woody rhizome, not producing tunicated bulbils. Stems 10-30 cm., at top trigonous, at base nodose, wiry, often flexuous. Leaves shorter or as long, usually subulate and squarrosely recurved. Bracts 3, up to 7.5 cm. long. Umbel of 4-6 rays, sessile or with peduncles up to 30 mm. long, bearing 3-8 spreading spikelets. Spikelets ovate- or linear-oblong, hardly compressed, 6-15 mm. long; glumes densely imbricate, broadly ovate when expanded, plicate, acute, 2.5 mm. long, red, keel greenish, margins broadly hyaline, the lowest sometimes scarious. Nut obovoid, plano-convex, dorsal surface hardly keeled, dark brown.

*Locality*: *Sind*: (Pinwill ex Clarke).—*Cutch*: On sandy seashore (Blatter ex J.B.N.H.S.).—*Konkan*: Bombay (Jacquemont 430 ex Clarke), seashore (Herb. Sedgwick & Bell 7318 !); seaface near Mahalaxmi Battery, among rocks and gravel (McCann 358 ! 359 !); Mahim, shore (Blatter 2741 !).—*N. Kanara*: Karwar, on rocks by the sea (Sedgwick & Bell 6758 !, Hallberg & McCann C125 !), sandy seashore (Sedgwick 5050 !).

*Flowering & fruiting*: March 23rd, 1929 (Mahalaxmi Battery); October 1919 (Karwar); December 1915 (Mahim); December 1918 (Karwar); Bombay (December 1919).

*Field notes*: Essentially a maritime species. Growing among rocks, gravel and sand, usually a little below the high water mark. Stolons thick, strong, horizontal with a strong perpendicular root descending from the base of each sucker. Very difficult to extract. Inflorescence inclined to droop, pale yellowish green. Stems erect, trigonous just under the umbel. Leaves dark green, recurved.

Near Mahalaxmi Battery it forms a dense carpet often mixed with *Fimbristylis polythrichoides*.

*Distribution*: Shores of India, especially in sea sand.—Ceylon, Malay Peninsula, Mauritius, China, Malaya, Australia.

34. **Cyperus exaltatus** Retz. Obs. v (1789) 11; Cke. ii, 872.—For synonyms see C. B. Clarke in Hook. f. F.B.I. vi, 617.

*Description*: Cke. l.c.

*Locality*: *Gujarat*: Marshy banks of the Watrak River, Modasa Petha (Sedgwick 1058 !); marshy places on the Watrak River banks (Saxton & Sedgwick Pl. N. Guj. R.B.S.I. vi, 306); Sevalia, Kaira Dist. (Chibber !).—*Khandesh*: Bor, Tapti River, sandy mud (Blatter & Hallberg 3030 !); Dhulia, Thikhi tank (H.E.B.B. !); Dadgaon (Blatter, Hallberg & McCann 29586 !); Toranmal (Blatter, Hallberg & McCann 29575 !).—*W. Ghats*: Khandala, in a rivulet (Sedgwick 2572 !, Blatter 1854 !, Blatter & McCann 3165 !, Blatter, Hallberg & McCann 2410 ! 3056 !, McCann C207 !); Lonavla (Woodrow ex Cooke; Blatter, Hallberg & McCann 3148 !); Londa (Gammie !).—*Deccan*: (Dalzell & Gibson ex Cooke); Lena Hill, Nasik (Blatter & Hallberg C137 !).—*Konkan*: Dhobi Talao, Bombay (Blatter & McCann 3092 !), St. Xavier's

College grounds (McCann 2799 !); Pen (Blatter, Hallberg & McCann 3227 !); near Budlapur (H.E.B.B. !); Mulland, in a swamp (McCann 1270 ! 1271 ! 1272 !); Sion (McCann 966 !); hills W. of Vickroli, in a swamp (McCann 1022 !); Borivli, in a ditch (McCann 1113 ! 1114 ! 1115 !); Kondita (Blatter, Hallberg & McCann 3082 !); Vehar Lake (Blatter & McCann 2753 !); Varol tank, near Bhivandi (McCann 1695 ! 1712 !); Karjat (Woodrow ex Cooke).—*S. M. Country*: Dharwar, 2,400 ft., rainfall 34 in. (Herb. Sedgwick & Bell 4977 !, Sedgwick 1858 !); Nigadi, bank of tank (Sedgwick 5709 !); Belgaum (D.F.O. !); Haveri (Talbot 2227 !); Kilgerry (Talbot 2950 !); Devikope (Talbot 1064 !), at 2,000 ft., rainfall 45 in. (Sedgwick 2971 !); Dambal, Dharwar Dist. (Dalzell ex Cooke).—*N. Kanara*: Yellapur (Talbot 1064 !); Kincholi (Talbot !).—*Bombay Pres.*: Bawli (H.E.B.B. !).

*Flowering & fruiting*: May 25th, 1914 (Belgaum); July 1916 (Khandala); July 1917 (Khandala); August 11th, 1929 (Mulland); August 25th, 1929 (Sion, Vickroli); September 1918 (Khandala); September 15th, 1929 (Borivli); September 27th, 1895 (near Budlapur); October 1899 (Londa); October 1905 (Khandala); October 26th, 1930 (Varol Tank); November 1896 (Bawli); November 1916 (Vehar); December 1916 (Kondita); December 1918 (Toranmal, Dadgaon); December 1919 (Lena Hill); December 3rd, 1907 (Sevalia); December 28th, 1907 (Dhulia).

*Field notes*: A species appearing during the monsoon. Commences to flower in July. It persists in suitable localities long after the monsoon is over, even as far as January, February—rarely till May. Otherwise it dies down soon after the rains when the marshes dry. The plant generally grows in water, in pools and marshes formed during the rains with about $\frac{2}{5}$ to $\frac{1}{3}$ of the stems submerged. The stems are densely tufted and black up to the point of the water level—3-gonous, solid, polished. The rhizomes form a dense black knotty mass with numerous black roots.

The inflorescence is at first erect but soon spreads out when fully developed. When young the spikelets are from light straw coloured to golden brown but become dark brown when mature. Stems frequently bend down with the weight (? may have been knocked down) of the umbel when fully mature, and are often submerged, in which case the spikelets become almost black but do not decompose.

A most variable species in appearance especially from the juvenile to the mature state.

*Uses*: This tall sedge is used for matting (Prain, Fl. Sundribuns. Rec. Bot. Surv. Ind. vol. ii, p. 351).

*Distribution*: All over India.—Tropical and subtropical regions.

**Var. dives** C. B. Clarke in Journ. Linn. Soc. xxi (1884) 187; Cke. ii, 873.

*Description*: Cke. l.c.

*Locality*: *Sind*: (Pinwill ex Cooke).—*Gujarat*: Godhra (H.E.B.B. !); Dakose, Kaira Dist. (Chibber !).—*Khandesh*: Chinchpada to Borpada, Dhulia (Chibber !); Nimb, Tapti bank (Blatter & Hallberg 4442 ! 1997 !).—*W. Ghats*: Lonavla (Talbot 4797 !); Purandhar (Blatter & McCann C135 !).—*Deccan*: Pandu, Lena Caves, Nasik (Jeuken !); Poona, Ferguson College garden, in muddy tank (Paranjpye !); Bairawadi, Purandhar (Blatter & McCann C135 !).—*S. M. Country*: Dharwar, in pools (Sedgwick 1858 ! 4977 !).

*Flowering & fruiting*: January 1st, 1908 (Chinchpada to Borpada); March 12th, 1905 (Nasik); November 8th, 1911 (Ferguson College); December 1916 (Nimb); December 1917 (Bairawadi); December 5th, 1907 (Godhra).

*Field notes*: This variety, in our opinion, should be classed as a variety of *C. radiatus* Vahl which it more closely resembles. There is also another point in common between this and the true *C. radiatus* Vahl, and that is an exudation of a resinous secretion from the margins of the glumes, which is not produced by *C. exaltatus* Retz. This point has so far been overlooked, possibly owing to the secretion being mistaken for the gum used for pasting the specimens on the sheets. The exudation was first observed by us in the field and was later confirmed by herbarium material. The general colour of the inflorescence of this variety is yellowish green, turning yellowish later and eventually a light brown. The young portions of the spikelets are at first green, then yellowish and finally light brown.

The habit is much like that of *C. radiatus*, in marshes on the banks of pools and in pools themselves. Often in water $\frac{1}{3}$ of the way up the stem. The plants (at least those from the N. of the Presidency) are generally much larger and of a paler green in general tone. The spikes are frequently longer than those of *C. exaltatus* and more flexuous. The secretion from the margin of the glumes seems to us to be a good character. It frequently flakes off in old herbarium material leaving the glumes as though highly polished.

*Distribution*: Bombay Presidency, Bengal, Chittagong.—Africa.

35. **Cyperus digitatus** Roxb. Hort. Beng. (1814) 81; Cke. ii, 873.—For synonyms see C. B. Clarke in Hook. f. F.B.I. vi, 618.

*Description*: Cke. l.c.

*Locality*: *Bombay Pres.*: Ambowne, rice fields (Gammie 15995 !).—*W. Ghats*: Khandala, in a rivulet (Sedgwick 2572 !), soldiers' playground, watercourse (Blatter & McCann 2401 !, McCann C219 !); Lonavla (Woodrow ex Cooke, Paranjpye !), along river (Chibber !, Gammie 15493 ! young state, Blatter, Hallberg & McCann 28001 ! 28233 !); Panchgani, 3rd Tableland, W. face (Fernandez 203 ! 204 ! 205 !); Panchgani to Mahableshwar, in a rocky nulla (Blatter C199 !); Londa (Cooke).—*Deccan*: Poona (Woodrow 204 ex Cooke), Ganeshkhind Gardens (Garade ! young state).—*Konkan*: (Law ex Cooke); Satiwali, Bassein (Ryan 1181 !).—*S. M. Country*: Dharwar, 2,400 ft., rainfall 34 in. (Sedgwick & Bell 4978 !); Devarayi, 1,800 ft., rainfall 90 in. (Sedgwick 4467 !).—*N. Kanara*: Arbail Ghat, 1,500 ft., rainfall 300 in., water hole (Sedgwick 6581 !).

*Flowering & fruiting*: June 13th, 1902 (Ganeshkhind); August 10th, 1903 (Satiwali); September 12th, 1895, September 22nd, 1902, September 29th, 1914, October 1918, October 7th, 1907 and November 1918 (Lonavla); November 12th, 1929 (Panchgani to Mahableshwar); November 26th, 1929 (Panchgani).

*Distribution*: From the Punjab to Ceylon, Assam and Penang.—S.-E. Asia, Australia, tropical Africa, Madagascar, throughout the warmer parts of America.

(*To be continued*).

# STALKING A HERD OF SAING.[1]

## (Good Sport with a Camera in Burma.)

BY

E. H. PEACOCK.

(*With 3 plates*).

An exasperated sportsman once recorded that the intelligence of an old *saing* bull was so much greater than that of all other game that he was capable of any feat of cunning except, perhaps, walking backwards with a view to confusing those who might be following his tracks!

The big game hunter is concerned only with the old bulls. If he has had a fair measure of experience he will waste no time in 'still-hunting' for these wild oxen. As he traverses the forests his eyes are on the ground, seeking always for the fresh tracks of an indubitably old warrantable bull.

When he finds such tracks he must follow them along the hard and tortuous course that those tracks will inevitably lead him. Too often the end of that trail is marked by a sharp snort, the crash of a heavy body breaking through cover and a glimpse, perhaps, of something red and white vanishing quickly through the green maze of the forest.

This experience is so terribly common. The young bulls and cows do not possess in so marked a degree that uncanny sixth sense of danger with which the old bull disconcerts his pursuers.

### 'CAUGHT' THROUGH HIS LADY FRIENDS.

The best of the old bulls generally prefer a solitary life. Occasionally, however, they will join herds and, in that state, they may be led by their lady friends into situations which they would avoid in their solitary condition. The 'leary' look in the eye of the bull photographed at a 'lick' in a northern game sanctuary indicates plainly that it was entirely foreign to his nature to be caught out in so childish a fashion.

This was a case of 'lick' photography, entailing a good deal of patience, it is true, but a sedentary occupation, nevertheless, and having small relationship to the labour and woodcraft involved in the more virile sport of getting alongside a truly warrantable head with a rifle. 'Still-hunting' with a camera for herds of *saing*, however, is pure pleasure, and respectable sport withal, even to the mind of the conservative big game hunter who scorns 'licks' and water-holes and allied places and means of obtaining easy sport.

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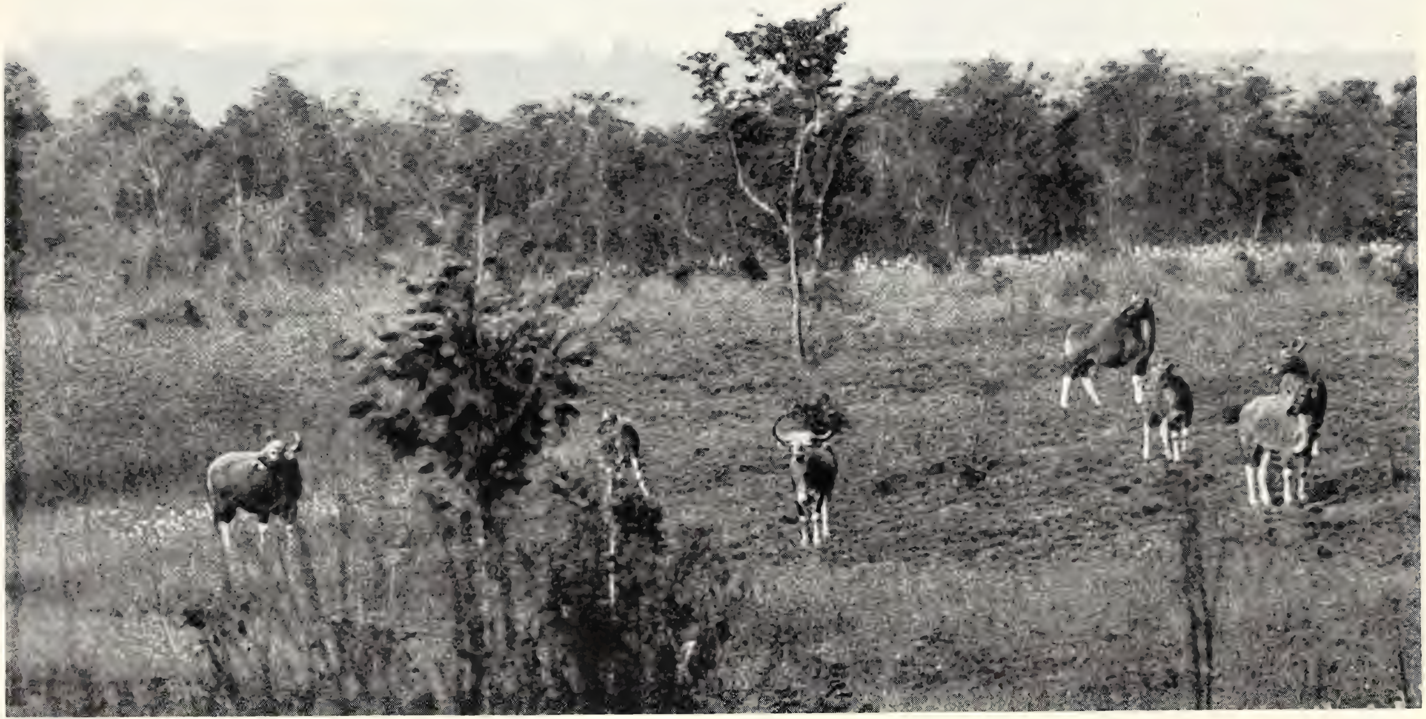
[1] Reprinted by courtesy of the *Field*.



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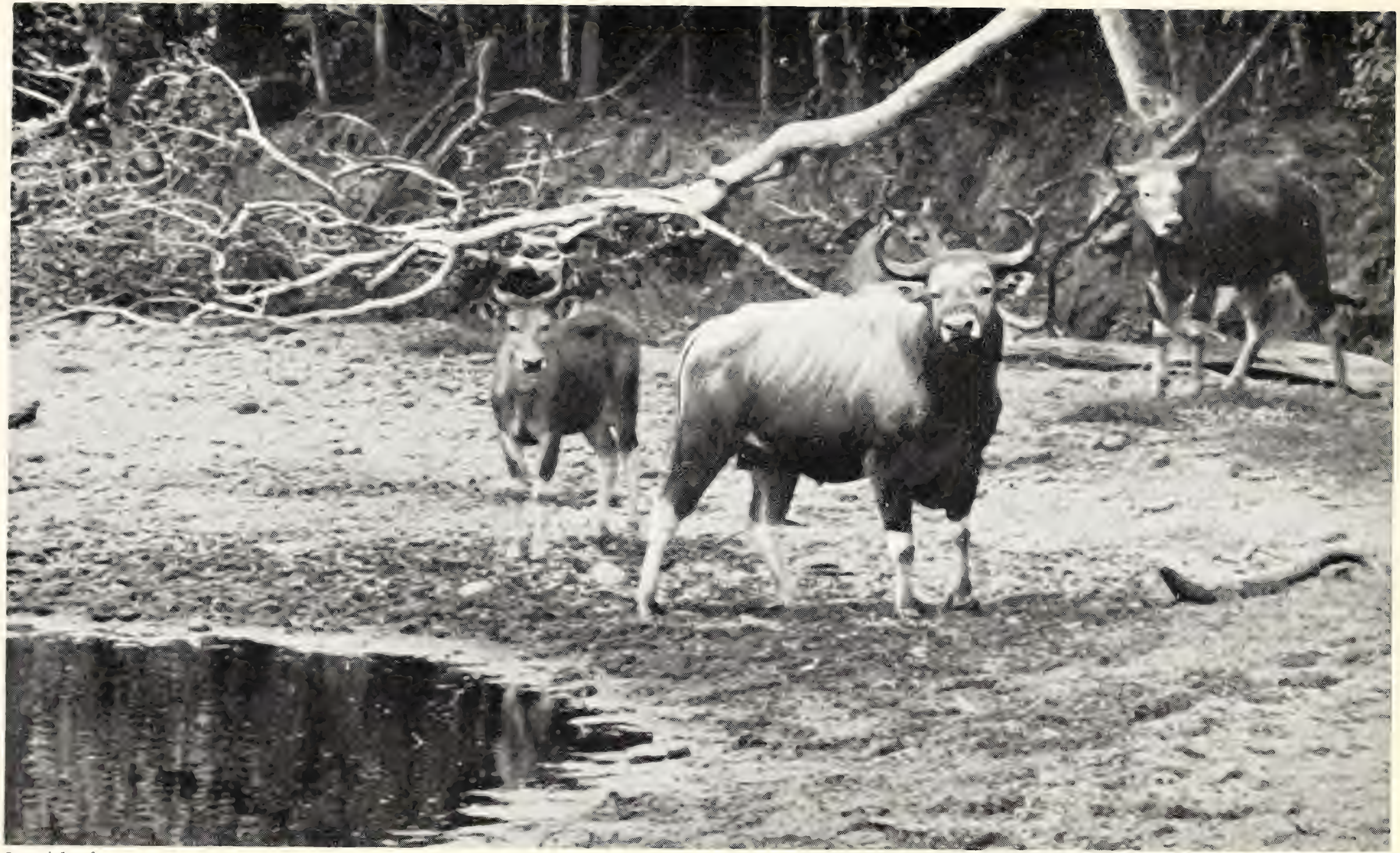
A herd of Saing (*Bibos banteng*, Lyd.) in a typical Burmese *lwin*: the master-bull of the herd is seen on the left of the picture.



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An old bull Saing (*Bibos banteng*, Lyd.) photographed at a 'lick' in a Northern Burma Game Sanctuary.

When the annual ground fires of March and April have cleared the heavy undergrowth from the woods and burnt the long rank grass in the clearings, it is pure delight to 'still-hunt' for *saing* in the fresh rainswept mornings and evenings of the early monsoons. It is a different proposition to tracking down the bull of one's choice, and it lacks the strained, half-savage climax when the rifle connects with its game; but it is even greater fun than lying in wait at a 'lick' for such game as may chance to walk up to the camera.

Two of the other photographs here reproduced were the reward of a day spent in 'still-hunting' with a camera. A terribly wet day in May brought us no luck in the forenoon, and despite our strongest imprecations the rain clouds continued to blot out the sun, while the ceaseless drizzle of rain lent a most dreary appearance to the *lwins* and took all the heart out of us, keen as we were. A couple of hours before sundown my patience was completely worn away.

'I've had enough of this so-and-so weather,' I said to my companion. 'I'm going back to camp.'

But when we were well inclined to the homeward route the clouds fell away and the tree-tops above us were splashed with gold. The camera hunter is, of course, first cousin to the sun-worshipper—and what a worthy object of worship it is, to be sure, after a long day of tramping through sodden woods! We gave thanks and bent our line towards a clearing where we might take unawares a sambur or a barking deer.

When we reached this *lwin* of short new grass, half of it was ablaze with sunlight, so that we must keep to the shadowed side and stalk slowly along the skirts of the forest. For a while we saw no game, but on turning a bend in the line of woods I saw, to my delight, a small herd of *saing* feeding near the edge of the forest in a light-flooded bay of the clearing.

They were grazing in ankle-short grass, and their bright red and white bodies presented a wonderful splash of colour against the sombre woods behind them.

I could not stalk this herd by following the line of woods on our side of the *lwin* because the wind was blowing from that side. Neither could I circle right round the clearing and come up-wind to them, because it would have consumed more time than the sinking sun would have allowed us.

My only hope of obtaining a picture before the sun went down lay in a direct crawl of about 150 yds. to the cover of some small bushes growing right out on the *lwin* and within about 80 yds. of the herd.

When Kipling's Mowgli conducted his man through the 'hundred agonies of a jungle stalk' he had, at most, only a solid rifle to lug along—my delicate camera with its 5 ft. long tripod legs created a few additional agonies.

It was a case of 'lie flat when their heads are up and move on when their heads are down; and no dawdling on the way in case the light fails.' But eventually I reached a bush about 4 ft. high, behind which I sat down and straddled the tripod legs about me, raising the lens very slowly above the level of the bush.

## CAUTIOUS APPROACH.

When this had been done I raised my head to the level of the camera, quite resigned to the possibility of the animals having detected me in the uncanny way they often do: but they were all there, and a minute later I had made my first exposures, using the very small aperture and correspondingly long exposure necessary to obtain the clear definition required for a fair enlargement of a long-range photo.

Eighty yards, however, is a very long range for a photograph, so, after making a number of careful exposures, I decided to see how much closer I could approach. Stepping clear of the bush when their heads were down and holding the camera and extended tripod before me I merely walked slowly towards them, standing still at the first sign of a lifting head. I covered fully 30 yds. in this manner, and made two exposures before I was seen.

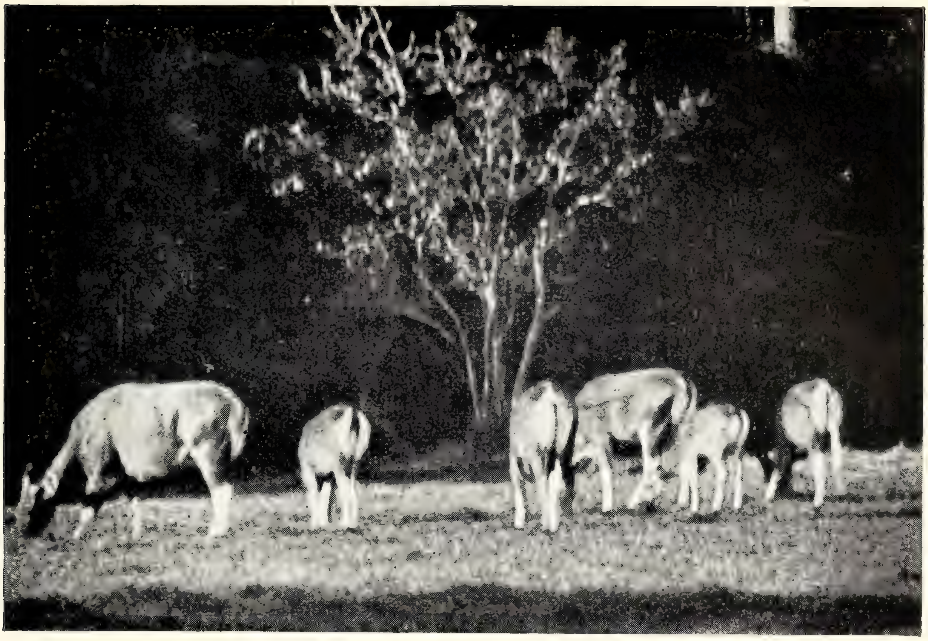
Even so, I was not detected in actual movement, and the *saing* could make nothing out of the queer object with three thin legs and two fat ones which had suddenly appeared within their vision. So they clumped together and stared in astonishment, while I made the last exposure of the evening.

What a pity it is that there is no way of developing and printing one's negatives within a few minutes of making an exposure. The climax in the dark-room—after one has returned to a stuffy tent, seen the objectionable features of one's mail-runner, and delved into his large green bag of official correspondence—is too long delayed for any but an exceptionally cold-blooded nature.

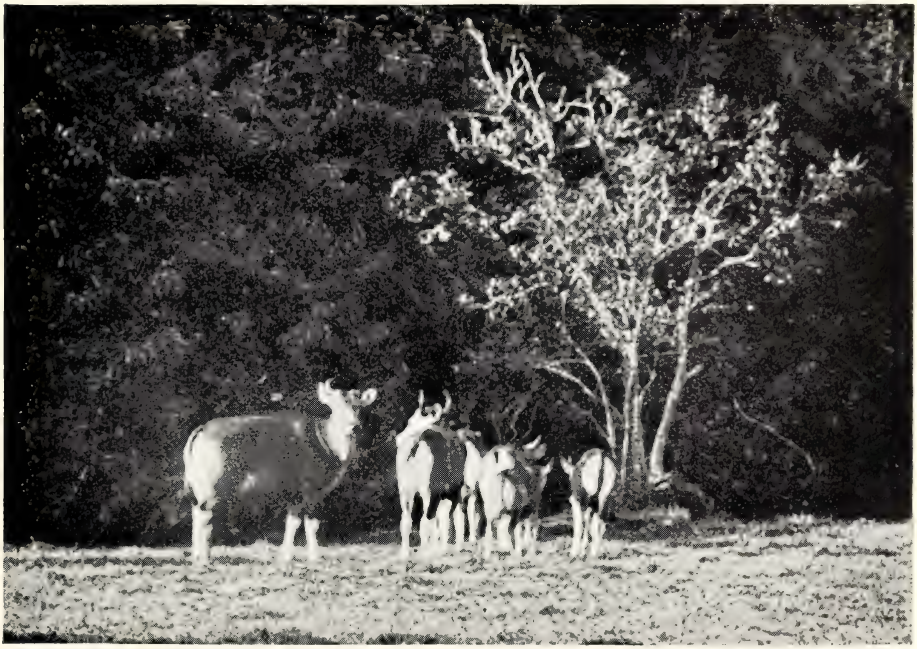
## COMPENSATIONS.

But there are compensations, one supposes. I recollect walking home many miles one day in a very exalted frame of mind in the certitude that I had achieved a priceless photograph of a sambur herd containing two fine stags.

The climax—I shall never forget it—was the realisation that I had committed the ghastly blunder of making two exposures—two perfectly good exposures—on one plate!



A small herd of Saing (*Bibos banteng*, Lyd.) feeding in a light-flooded bay of the *lwin*.



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"They clumped together and stared with astonishment."

# THE VERNAY SCIENTIFIC SURVEY OF THE EASTERN GHATS. (ORNITHOLOGICAL SECTION).

BY

Hugh Whistler, M.B.O.U., assisted by N. B. Kinnear, M.B.O.U.

## PART VIII.

(*Continued from page* 105 *of this volume*).

### **Zosterops palpebrosa salimalii** Whistler.

*Zosterops palpebrosa salimalii* Whistler, J.B.N.H.S., xxxvi, (15 December, 1933), p. 811—Ferahabad 2,688 ft., S.-E. Hyderabad.

Specimens collected:—197-199 ♂ ♀ ♀ 11-5-29, 257 ♀ 258 ♂ 260-261 ♂ ♂ 21-5-29 Shevaroy Hills 3,500-4,800 ft.; 402 ♂ 13-6-29 Chitteri range 3,000 ft.; 842 ♀ juv. 28-9-29, 848 ♀ 29-9-29 Seschachalam Hills 2,000 ft.; 943-946 ♂ juv., ♀ ♂ ♂ 31-10-29, 961-962 ♂ o? 3-11-29, 968 ♀ 4-11-29, 1011 ♂ 16-11-29 Nallamallai Range 2,000 ft.

Measurements:—

| | Bill. | Wing. | Tail. | Tarsus. |
|---|---|---|---|---|
| 10 ♂ | 11.5-12 | 53-57.5 | 37.5-40 | 14-15.5 mm. |
| 6 ♀ | 11-12.5 | 51.5-55.5 | 35.5-39 | 14-15 mm. |

Our information about the Common White-eye on the eastern side of the Presidency below the Godavery is confined to the above series of specimens and LaPersonne's note that he found it very common in the Shevaroy and Chitteri ranges where it is known to the Planters as the White-eyed Tit. On the Shevaroys they were particularly partial to the Silver Oak-trees. From the notes on the labels regarding the organs they appear to have been breeding in May.

Students of this difficult group will remember that Stuart-Baker (*New Fauna*, vol. iii, p. 358 *et seq.*) and Ticehurst (Bull. B.O.C., xlvii, February 1927 and J.B.N.H.S., xxxii, p. 354) have come to very different views as regards the Indian races of *Zosterops palpebrosa*. My own investigations corroborate those of Ticehurst and as he has gone into the matter in considerable detail there is no need for me to reopen the subject here.

### **Zosterops palpebrosa occidentis** Ticehurst.

*Zosterops palpebrosa occidentis* Ticehurst, Bull. B.O.C., vol. xlvii, no. cccxii (February 1927), p. 88—Simla.

Specimens collected:—1336 ♂ 6-2-30, 1415 ♂ 20-2-30, 1427 ♂ 22-2-30, 1431 o? 23-2-30 Anantagiri, 3,000 ft.; 1484 ♂ 6-3-30, 1498-1500 ♀ ♂ ♂ 8-3-30, 1517 ♂ 11-3-30, 1576 ♂ 20-2-30, 1598 ♂ 24-3-30, 1601 ♀ 26-3-30, 1652 ♀ 3-4-30, 1673 ♂ 12-4-30, Sankrametta 3,000-3,800 ft.; 1702 ♂ 19-4-30 Jeypore Agency 3,000 ft.

Measurements:—

| | Bill. | Wing. | Tail. | Tarsus. |
|---|---|---|---|---|
| 11 ♂ | 12-13 | 54-57 | 38.5-42 | 15-16.5 mm. |
| 3 ♀ | 12 | 54-55 | 39-41 | 15-15.5 mm. |

Mr. LaPersonne says that in the Vizagapatam district the White-eyes were extremely common all over the hills both in forest and open country. They were in flocks in May though the organs of the specimens suggest that they were then breeding.

I cannot separate the above series of White-eyes from the North-Western form which Ticehurst has already shown occurs in the Central Provinces as far east as Raipur.

**Zosterops palpebrosa nilgiriensis** Ticehurst, Bull. B.O.C., vol. xlvii, no. cccxii (February 1927), p. 88—Coonoor.

This dark large-billed race of the White-eye is confined to the west of the Presidency. Betts says that it is common in Coorg. William Davison considered it rare in the low country of the Wynaad, but it grows increasingly common as the country rises and it is very abundant in the higher ranges of the Nilgiris. It is very common in the Nelliampathies, the Palnis and throughout the hill range of Travancore from north to south from 1,000 ft. upwards.

The breeding season appears to be from March till May.

[The reported occurrence of *Zosterops ceylonensis* at Coonoor on 5 June, 1903 (Hatchwell, J.B.N.H.S., xv, 726), must certainly be due to wrong identification.]

### [**Aethopyga siparaja vigorsii** (Sykes).

*Cinnyris vigorsii*, Sykes, P.Z.S. 1832 (July 31), p. 98—Dense woods of the Ghauts.

The *New Fauna* (vol. iii, p. 382) is wrong in stating that Vigor's Yellow-backed Sunbird occurs on the west coast of India from Bombay to Travancore. It does not occur in the Madras Presidency and there appears to be no record from below the South Konkan.].

### **Cinnyris lotenia** (Linnaeus).

*Certhia lotenia* Linnaeus, Syst. Nat., ed. xii (1766), p. 188—Ceylon.

Specimens collected:—21 ♀ 11-4-29, 83 ♀ 85 ♂ 19-4-29, 151 ♂ 29-4-29 Kurumbapatti; 1037 ♂ 25-11-29 Nallamallai Range 2,500 ft.

Measurements:—

| | Bill. | Wing. | Tail. | Tarsus. |
|---|---|---|---|---|
| 2 ♂ | 25-27.5 | 57 | 37-38 | 15-15.5 mm. |
| 3 ♀ | 25.5-28 | 53-53.5 | 33-35 | 14.5-16 mm. |

The above specimen from the Nallamallai Range extends the known distribution of Loten's Sunbird which on the east side of India has hitherto not been recorded north of Madras where it is very common. On this side in addition to the Survey specimens it occurs at Salem, Pondicherry and Trichinopoly, from all of which places there are specimens in the British Museum, and it is probably generally distributed down to Cape Comorin as a single specimen (in the British Museum) was seen and obtained by Fairbank at the eastern base of the Palnis while Ferguson says that it is common in the low country of Travancore, ascending the hills to 2,000 ft.

In the north-west of the Presidency it is evidently general and common. It has been recorded or obtained at Tellicherry (Jerdon), Calicut (Dr. Day), Coorg (Tweeddale collection), the Wynaad (where William Davison found it generally distributed) and the Nilgiris where it occurs on the slopes up to 5,000 ft. or rather more (William Davison).

Dewar says that the breeding season at Madras is in February and March.

Indian and Cinghalese birds are not separable. I have seen no evidence that Loten's Sunbird sheds the brilliant male plumage in winter[1] and I have seen specimens in that plumage in every month except July, August and December. William Davison (S.F., x, 362) and Dewar (J.B.N.H.S., xvii, 540) held opposite views on the point. The *New Fauna* fails to make clear the proportionately large size of the beak. It gives the culmen as measuring 16 to 19 mm., whereas in the five Survey specimens it measures from the feathers 22.5-25 mm.

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[1] Dr. C. B. Ticehurst informs me that he has seen specimens moulting from the metallic plumage to metallic plumage from September to November, i.e. definite evidence that there is no eclipse winter plumage.

### **Cinnyris asiatica astiatica** (Latham).

*Certhia asiatica* Latham, Index Orn., vol. i (1790), p. 288—India.

Specimens collected:—320 ♀ 3-6-29 Chitteri Range 2,000 ft.; 540 ♀ 17-7-29 Gingee; 843 [♂] 28-9-29, 879 ♂ 5-10-29 Seschachalam Hills 2,000 ft.; 1162 ♂ 23-12-29, 1180 ♂ 27-12-29 Cumbum Valley; 1351 ♂ 8-2-30, 1360 ♂ 9-2-30, 1395 ♂ 16-2-30, 1709 ♀ 4-5-30 Anantagiri 3,000 ft.; 1501 ♂ 8-3-30, 1669 ♂ 6-4-30 1521 ♀ 11-3-30 Sankrametta 3,000 ft.

Measurements:—

| | Bill. | Wing. | Tail. | Tarsus. |
|---|---|---|---|---|
| 9 ♂ | 20-21 | 55-59 | 33.5-36 | 14-14.5 mm. |
| 4 ♀ | 19.5-21 | 52-53.5 | 29-34 | 13.5-14 mm. |

The Purple Sunbird appears to be very generally distributed all down the eastern side of the Presidency, occurring in the hills up to at least 3,000 ft., especially in the Vizagapatam area where LaPersonne found it very common. About Madras itself it is said to be numerically less abundant than Loten's Sunbird. On the west it is evidently more patchy in distribution, with some curious anomalies. In the Wynaad and at the foot of the Nilgiris William Davison says that it is entirely replaced by Loten's Sunbird, though according to Jerdon—and Mr. Betts confirms this—it occurs in the Nilgiris at all higher elevations up to 7,500 ft. In the Palnis and the Travancore Hills, on the other hand, Fairbank and Ferguson say that it is not found except around their bases. In the Presidency this Sunbird is a resident.

In the Nilgiris, Miss Cockburn gives the breeding season as January. Rhodes Morgan gives the breeding season for the Presidency generally as from February to June, most nests being constructed in March and April.

Ticehurst has already shown that the north-western race *brevirostris* has a seasonal change of plumage (J.B.N.H.S., xxvi, p. 286 and Ibis 1923, p. 24). This is the case also with the typical race in the Presidency. The complete postnuptial moult takes place between the beginning of July and early October and the non-metallic plumage—easily distinguished from the immature plumage, in which the male and female are alike, by the dark wings, and from its short period of retention meriting the name of 'eclipse' rather than winter plumage—is shed again in November to December by a complete body moult. The shortness of this eclipse explains the divergence of opinion as to its existence.

Birds from Ceylon are not separable.

### **Cinnyris minima** Sykes.

*Cinnyris minima* Sykes, P.Z.S. 1832 (July 1), p. 99—Dense woods of the Ghauts.

The range of the Small Sunbird lies outside the area covered by the Survey. It is confined in the Presidency to the western side and there is as yet only recorded from the hill areas. It occurs throughout the Wynaad and the Nilgiris being most abundant and the commonest of the genus at high altitudes, especially on the plateau. In the Palnis it is common from 4,000 ft. to the summit (Fairbank). In Travancore it is common on the High Range and at all elevations in the hills of the south (Ferguson).

Mr. Betts informs me that the breeding season in the Nilgiris is in March and April and again in September. William Davison says that it breeds there in September and early October. In Travancore the breeding season is variously given as December to January (Ferguson) and February to April (Stuart Baker).

This Sunbird appears to have a seasonal change of plumage. I have only seen fully iridescent males from August to April and specimens dated in May and June are in a plumage similar to that of the female except that the lower back, rump and upper tail-coverts retain their iridescent colours. This postnuptial eclipse is also noted by Fairbank (S.F., iv, 256) and Davison (S.F., x, 362).

*Nectarinia minima* Tickell [J.A.S.B., vol. ii, 1833 (after November), pp. 569-582], described as common in Sal Jungle in Borabhum and Dholbhum of course cannot be this species. The description is very poor but it evidently provides an overlooked synonym for *Cinnyris asiatica.*

### **Cinnyris zeylonica** (Linnaeus).

*Certhia zeylonica* Linnaeus, Syst. Nat., ed. xii, vol. i (1766), p. 188—Ceylon.

Specimens collected:—20 ♂ 11-4-29, 67 ♂ 16-4-29, 146 ♂ 28-4-29 176 ♀ 3-5-29 Kurumbapatti; 296 ♀ juv. 20-5-29, 318-319 ♀♀ juvs. 3-6-29, 355 ♂ imm. 7-6-29 Chitteri Range 2,000 ft.; 507 ♀ juv. 4-7-29 Kalai, Trichinopoly; 562 ♀ 19-7-29, 567 ♂ 20-7-29 Gingee; 705 ♂ 18-8-29 Palkonda Hills 1,000 ft.; 776 ♀ 31-9-29 Kodur; 866 ♀ 3-10-29, 896 ♂ 10-10-29 Seschachalam Hills 2,000 ft.; 986 ♂ 9-11-29, 1013 ♂ 16-11-29, 1036 ♂ 25-11-29, 1004 ♀ 13-11-29, 1012 ♂ imm. 16-11-29 Nallamallai Range 2,000 ft.; 1111 ♂ 14-12-29, 1160 ♂ 23-12-29 Cumbum Valley.

Measurements:—

| | Bill. | Wing. | Tail. | Tarsus. |
|---|---|---|---|---|
| 11 ♂ | 17-19 | 51-58 | 30-35.5 | 15-17 mm. |
| 5 ♀ | 16-17.5 | 52-55.5 | 30-32.5 | 14-15.5 mm. |

Hume tells us (S.F., v, 270) that the Purple-rumped Sunbird is found throughout the Madras Presidency but I have so far failed to trace any record from the area north of the Godavery Valley and it was not reported by the Survey from the camps in the Vizagapatam Hills. South of the Godavery it is so common—indeed it is the common species of Sunbird in the Presidency—and generally distributed that it is here only necessary to point out certain exceptions. In the Nilgiris it is said by William Davison to occur only up to 2,500 ft. In the Palnis Fairbank's account implies that that it is only found at the lower altitudes. In Travancore Ferguson says that it is never found in the hills.

The breeding season is said to be February and March in Travancore (Ferguson). At Madras it is also mainly in March (Dewar). William Davison however saw young in a nest at Madras late in December (N. & E., 2nd. ed., ii, p. 263) and Theobald (*loc. cit.*, p. 264) considered that at Sooramungalum, Salem August was the laying season.

There are no separable races of this species but the bill averages slightly longer in the Bombay Presidency than in Ceylon. The male of this species does not moult into a non-metallic winter plumage, and the young male assumes the metallic plumage at the postjuvenal moult. This accounts for the apparent increase of the adult males at the end of the hot weather in Coorg as remarked on by Betts (J.B.N.H.S., xxxiii, p. 547).

### **Arachnothera longirostra longirostra** (Latham).

*Certhia longirostra* Latham, Index Orn., vol. i (1790), p. 299—Bengal.

Not obtained by the Survey. The Little Spider-Hunter is in the Presidency confined to the western side. Never very numerous it is found on the Malabar Coast, throughout the Wynaad, on the slopes of the Nilgiris up to about 5,500 ft., in the Nelliampathies and Palnis (4,000 ft.) and throughout the Travancore Range from about 2,000-5,000 ft.

The only breeding record I have seen for our area is that by Cardew (J.B.N.H.S., x, 149) of two nests between June and September at Ootacamund.

I can find no difference between birds from S.-W. India and the Duars. Assam topotypical range.

### **Dicaeum concolor concolor** Jerdon.

*Dicaeum concolor* Jerdon, Madras Jour. Lit. Sci., vol. xi (1840), p. 277—Malabar Coast.

The Nilgiri Flowerpecker is confined to the western side of the Presidency and was therefore not met with by the Survey. On the western side it is found throughout the Wynaad, all over the slopes of the Nilgiris and most abundantly on the plateau. It is common at Kodaikanal in the Palnis. In

Travancore, Ferguson says that it is common from the foot of the hills to the summits and may occasionally be found in the low country. According to the *New Fauna* (vol. iii, p. 430) the breeding season lasts from February to April, but many birds have second broods in May and June. Miss Cockburn however found eggs in January (N. & E., ii, 274).

In the *New Fauna* the race *D. c. subflavum* is said to be distributed in 'Belgaum, North to Khandala and Mahableshwar; east to the Central Provinces'. This race is based on three specimens from Belgaum, one from Savant Vadi and one from Mahableshwar in the British Museum, and appears to me to require confirmation. At any rate in Belgaum, Butler apparently considered it a rains visitor (S.F., ix, 391) and I have seen three specimens from the Nilgiris which could not be separated from the Belgaum specimens. The extension to the Central Provinces in any case cannot be accepted. It is based on a doubtful record from Bilaspur by Blanford which Hume threw doubt on fifty years ago (S.F., vii, p. 208).

Erroneous records are hard to eradicate. It may therefore be pointed out here that the record of *Dicaeum concolor olivaceum* breeding at Gorakhpur in April (J.B.N.H.S., xxii, 539) is incorrect. The specimen is in my collection and really pertains to *D. erythroryhnchos.*

*Cinnyris concolor* Sykes, P.Z.S. 1832, p. 99, does not refer to this species but is a synonym of *Æthopyga siparaja vigorsii* Sykes.

## **Dicaeum erythrorhynchos erythrorhynchos** (Latham).

*Certhia erythrorhynchos* Latham, Index Orn., vol. i (1790), p. 299—India (Restricted to Bombay *New Fauna*, vol. iii, p. 432).

Specimens collected:—576 ♂ 21-7-29 Gingee; 1352 ♂ 8-2-30 Anantagiri 3,000 ft.; 1483 juv. 6-3-30, 1489 ♀ 7-3-30, 1509 ♀ 9-3-30 Sankrametta 3,000 ft.; 1745 ♀ 29-4-30 Jeypore Agency 3,000 ft.

Measurements:—

| | Bill. | Wing. | Tail. | Tarsus. |
|---|---|---|---|---|
| 2 ♂ | 11-12.5 | 49-49.5 | 23-24 | 11.5-12.5 mm. |
| 3 ♀ | 10.5-11.5 | 46-47.5 | 22-24 | 12-12.5 mm. |

Tickell's Flowerpecker was found by the Survey to be common in the Vizagapatam Hills at Anantagiri and Sankrametta in February, March and April. This was evidently the breeding season as in addition to the juvenile obtained the females collected in March were either laying or had recently laid. The Gingee specimen provides the only other record for the eastern side of the Presidency.

On the west it is better known. Betts states that it is a common resident in Coorg, breeding about April. It occurs in the Wynaad and round the base of the Nilgiris (Burliar; Goodalor) and Colonel Sparrow has lent me a specimen collected at Malappuram, S. Malabar, on 14 June 1912. Fairbank says that it is common in the plains about the base of the Palnis—a specimen collected by him at Periakulam at the E. base of the Palnis on 5 January 1877 is in the British Museum—and that it was also sometimes observed on the hillsides. In Travancore, according to Ferguson it is found throughout the hills from their base to their summits, occurring also occasionally in the low country. He found a nest with young at Trivandrum on 16 March.

## **Piprisoma agile agile** (Tickell).

*Fringilla agilis* Tickell, J.A.S.B., vol. ii (November 1833), p. 578—Bhorabhum and Dholbhum.

The Thick-billed Flowerpecker was not procured by the Survey and its distribution in the Presidency is not easy to define. I have only traced the following records. Jerdon says 'I have procured it in Goomsoor and the Eastern Ghats' (B. of I., vol. i, 376). There is a specimen in the collection of the Bombay Natural History Society collected by Mr. J. P. Cook in the Wynaad on 3 January 1894. In the Hume collection there are 4 specimens collected by Miss Cockburn at Kotagherry on 22 September 1874.

The amount of grey or green in the upper plumage of this Flowerpecker and the amount of streaking on the lower parts is purely a question of individual variation. There is only the one race throughout the range in the Indian Peninsula. Hume (S.F., i, 434) suggested that the Ceylon bird is separable but I have seen no specimens from that island.

### **Pitta brachyura** (Linnaeus).

*Corvus brachyurus* Linnaeus, Syst. Nat., ed. xii, vol. i (1766), p. 158—Ceylon.

Specimens collected:—15 ♂ 27 ♀ 11-4-29, 68 ♂ 16-4-29 Kurumbapatti.

Measurements:—

| | Bill. | Wing. | Tail. | Tarsus. |
|---|---|---|---|---|
| 2 ♂ | 23.5-24.5 | 106.5-107.5 | 37-40 | 36.5-37.5 mm. |
| 1 ♀ | 23.5 | 108 | 39 | 36.5 mm. |

The status of the Indian Pitta is well-known on the western side of the Presidency but on the eastern side we know comparatively little about it. Jerdon tells us that he saw it in Goomsoor (Madras Jour. Lit. Sci., x, p. 251). LaPersonne says that he saw and heard it at Sankrametta at 3,500 ft. in the thick evergreen forests though no specimens were actually collected. Between here and Nellore, where Jerdon says he found it exhausted on passage, there are no records. About Madras it is fairly well-known as a straggler in compounds and topes. Dewar considered it a resident but this seems unlikely and Jerdon who originally thought it a winter visitor says definitely that it occurs chiefly on the spring passage at the beginning of the hot weather when the strong winds blow from the west. Captain Bates however tells us of a bird picked up dead in December and there are three February specimens in the Hume collection.

The Survey found it common in the Kurumbapatti Forests in April and Mr. LaPersonne thought that it was breeding then, though this was not proved. Jerdon mentions it as occurring in winter at Trichinopoly.

On the west the records are definite that it is a winter visitor, fairly common in Coorg (Betts), never very numerous in the Wynaad and Nilgiris (William Davison), common in the Nelliampathies (Kinloch) and in Travancore (Ferguson). The latter says that it occurs in the low country and in the hills up to 2,500 ft. In the Nilgiris it is found as high as Ootacamund. Colonel Sparrow has a female killed at Malappuram on 14 December 1912. As this Pitta is a winter visitor to Ceylon from October to April it must be a passage migrant somewhere in the Presidency and this fact probably explains the records on the eastern side. The western birds doubtless travel up the line of the Western Ghats as there are various passage records for Mount Aboo, Deesa, Bombay, Sholapur, Belgaum etc. Much more information is, however, required before we can work out the breeding distribution and the marked migrations of this most interesting species, whose distribution and status are so obscured by the account in the *New Fauna*.

### **Picus xanthopygaeus** (Gray). [1]

*Brachylophus xanthopygaeus* Gray, Cat. Birds Nepal (1846), p. 117—Nepal. Nom nov. quoted as synonym of *Geocinus striolatus* (Blyth) 1843 preoccupied.

Specimens collected:—177 ♂ 5-29 Shevaroy Hills; 288 ♀ 29-5-29 Chitteri Range 2,000 ft.; 725 ♂ 21-8-29 Palkonda Hills 1,000 ft.

Measurements:—

| | Bill.[2] | Wing. | Tail.[2] | Tarsus. |
|---|---|---|---|---|
| 2 ♂ | 31-34.5 | 130 | 76-87 | 24-25.5 mm. |
| ♀ | 34.5 | 130 | 86.5 | 26 mm. |

The Little Scaly-bellied Green Woodpecker appears to be nowhere very numerous in the Presidency. For the Eastern side Jerdon's statement that he found it tolerably abundant in the Eastern Ghats is all that there is to supplement the above Survey records. On the west William Davison says that it is sparingly spread through the Wynaad and the Nilgiris. A few pairs are always to be found in the forests about Ootacamund but it is rarer at that elevation than lower down.

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[1] Mr. Betts' interesting note on the Woodpeckers of Southern India (*J.B.N.H.S.*, xxxvii, pp. 197-203) unfortunately appeared too late for inclusion in this paper.

[2] A good deal of variation in the size of the bills and tails of Woodpeckers must be discounted as they suffer greatly from wear.

In the Palnis Fairbank records it at Periur 4,000 ft. on 15 June while Terry says that he saw it 2 or 3 times at Pulungi and very frequently at Pittur.

Ferguson had only two records for Travancore—one specimen obtained at Cape Comorin in January 1902 and another at Quilon at the beginning of 1903.

The breeding season in the Presidency does not seem to have been recorded.

The reasons for not considering this Woodpecker a race of *Picus vittatus* have been given in detail both by Kloss (Ibis 1926, pp. 684-689) and Ticehurst (J.B.N.H.S., xxxvi, 932), and need not be repeated here. I have independently arrived at the conclusion elaborated by Ticehurst (*loc. cit.*) that Mr. Stuart Baker's North-Western Himalayan race *dehrae* [Bull. B.O.C., xlvi (1926), p. 69—Dehra Dun] is not recognisable.

## **Picus chlorolophus chlorolophus** Vieillot.

*Picus chlorolophus* Vieillot, Nouv. Dict. d'Hist. Nat., nouv. ed., vol. xxvi (1818), p. 78—Bengal.

Specimen collected:—1701 ♀ 18-4-30 Jeypore Agency 3,000 ft.

Measurements:—

| Bill. | Wing. | Tail. | Tarsus. |
|---|---|---|---|
| 25.5 | 125 | 86 | 19 mm. |

Evidently breeding as an incubation patch was present. This is a most interesting record. Not only does it provide an addition to the Presidency list but it suggests the correctness of certain old records which were discredited in the *Old Fauna*, vol. iii, p. 24 and omitted in the *New Fauna*, vol. iv, p. 17. For Ball says (S.F., vii, p. 206) that the Small Himalayan Yellow-naped Woodpecker occurs in Orissa, south of the Mahanadi, Cuttack (on Jerdon's authority), and probably Lohardugga. The single specimen collected lacks almost entirely the golden sheen on the upper parts which is almost invariably present in Himalayan specimens.

## **Picus chlorolophus chlorigaster**

*Picus chlorigaster* Jerdon, Madras Jour. Lit. Sci., vol. xiii, pt. 2, 1844 (after August 1845), p. 139—S. India.

Specimen collected:—1025 ♂ 22-11-29 Nallamallai Range 2,500 ft.

Measurements:—

| Bill. | Wing. | Tail. | Tarsus. |
|---|---|---|---|
| 28 | 127.5 | 88.5 | 20.5 mm. |

The South Indian Yellow-naped Woodpecker is best known on the western side of the Presidency. In Coorg according to Betts it is widely spread but nowhere numerous. Specimens from Cannanore (Wardlaw-Ramsay), Calicut (Hume collection) and the Wynaad (Hume collection) are in the British Museum and William Davison says that it is nowhere very common either in the Wynaad or in the Nilgiris where it occurs on the slopes up to 5,000 ft. Major Pythian Adams found a pair breeding as high as 6,000 ft. (Baker and Inglis, B. of S. India, p. 135). A specimen from Malappuram is in Col. Sparrow's collection. In Travancore it is fairly common in the hills at moderate elevations (Ferguson).

On the eastern side Stuart Baker (*New Fauna*, iv, p. 19) says that it is apparently found only from Madras southwards. The above Survey specimen, however, provides the only record which I have been able to trace on the eastern side.

The breeding season on the west is said to be from January to early May.

### **Dryobates macei macei** (Vieillot).

*Picus macei* Vieillot, Nouv. Dict. d'Hist. Nat., nouv. ed., vol. xxvi (1818), p. 80—Bengal.

Specimens collected:—1542 ♀ 1543 ♂ 14-3-30, 1559 ♂ 17-3-30 Sankrametta 3,500 ft.

Measurements:—

| | Bill. | Wing. | Tail. | Tarsus. |
|---|---|---|---|---|
| 2 ♂ | 23.5-25 | 103.5-105 | 60-61 | 17-18 mm. |

These specimens provide a considerable extension of the known range of the Fulvous-breasted Pied Woodpecker which hitherto has not been recorded south of Muddapur and Calcutta where it is said by Jerdon to be common.

The West Himalayan race of this Woodpecker *Dryobates macei westermani* Blyth (Ibis 1870, p. 163) should certainly be recognised as already pointed out by Dr. Ticehurst (J.B.N.H.S., xxxiv, p. 468). Not only is it considerably larger as shown by Dr. Ticehurst but the indistinct and broken gorget of black spots is more marked in the typical form than in the north-western bird. A series measured give the following results:—

| | Bill. | Wing. | Tail. |
|---|---|---|---|
| 5 ♂ Western Himalayas | 27-30 | 114-120 | 66-71 mm. |
| 8 ♂ Eastern Himalayas | 23-27.5 | 103.5-110 | 54-62.5 mm. |
| 3 ♂ Calcutta | 23-25 | 101.5-106 | 58-60.5 mm. |

There is a marked difference between the size of the sexes in this Woodpecker, as for instance six females (Western Himalayas) measure: bill 23.5-26; wing 109-113.5; tail 58-70 mm. The sexes must be compared separately.

### **Dryobates mahrattensis mahrattensis** (Latham).

*Picus mahrattensis* Latham, Suppl. Index Orn. (1801), p. xxxi—India, restricted to Belgaum Stuart Baker, *New Fauna*, vol. iv, p. 46.

Specimens colleccted:—191 ♀ juv., 192 ♂ 6-5-29 Kurumbapatti; 977 ♂-979 ♀ 7-11-29, 1019 ♂ 1020 [♀] 19-11-29 Nallamallai Range 2,000 ft.; 1515 ♀ 11-3-30, 1582 ♀ 22-3-30 Sankrametta 3,000 ft.

Measurements:—

| | Bill. | Wing. | Tail. | Tarsus. |
|---|---|---|---|---|
| 3 ♂ | 25-27 | 97.5-104 | 58-60 | 18.5-19 mm. |
| 4 ♀ | 21-24.5 | 99-109.5 | 57-61 | 17.5 mm. |

The Yellow-fronted Pied Woodpecker does not appear to be very plentiful in the Presidency and the above Survey specimens provide all the records for the eastern side.

On the west it occurs sparingly in the Wynaad and also in the drier foothills of the Nilgiris. Jerdon tells us that it is rare on the Malabar Coast but that he found it most plentiful in a patch of thin tree jungle near Wulliar in the gap of Coimbatore. Fairbank says—rather surprisingly I think—that it is not uncommon in the Palnis up to 5,000 ft. In Travancore Ferguson only records 2 specimens from Kuttyani about 10 miles from Travancore.

There is no published record of the breeding season in the presidency but on the label of no. 1582 shot at Sankrametta on 22 March Mr. LaPersonne has recorded that it contained a full-sized egg.

It is with considerable doubt that I have included the two Sankrametta specimens under this form. They have wings respectively of 102.5 and 109.5 and Sankrametta is not so very far from Bhorabhum, the type-locality of Tickell's *aurocristatus* which Ticehurst (J.B.N.H.S., xxxiv, 469) considers to be the correct name for the Northern and Burmese race. No specimens from Borabhum are in existence and from the neighbouring area Maunbhum there are only one pair of adults (♂ wing 102.5, ♀ 100 mm.) in the British Museum. Now *Dryobates mahrattensis* is evidently not a species which is very susceptible to climatic influences. It has developed no peculiar Malabar race and even if birds from the extreme north-west are compared with birds from the south the recognition of two races is only just feasible. The difference in colour is not constant, the amount of white is only just appreciable in a series, and there is much overlapping in measurements. The single pair from Maunbhum are not therefore really sufficient to settle the exact identity of *aurocristatus* with the northern and southern form, and it is probable, as a matter of fact, that birds from this area are intermediate. Under the circumstances I have kept the two Sankrametta birds with the typical race.

## **Dryobates hardwickii hardwickii** (Jerdon).

*Picus hardwickii* Jerdon, Madras Jour. Lit. Sci., vol. xiii (1844), p. 138—South India, Goomsoor.

Specimens collected:—128 ♂ 25-4-29 Kurumbapatti; 347 ♀ 6-6-29, 392 [♂] 12-6-29, 396 ♀ 13-6-29 Chitteri Range 2,000 ft.; 706 ♂ 18-8-29 Palkonda Hills 1,000 ft.; 1010 ♀ 1017 ♂ 19-11-29 Nallamallai Range 2,500 ft.; 1328 ♀ 5-2-30, 1406 ♂ 18-2-30, 1446 ♂ 26-2-30 Anantagiri 3,000 ft.; 1541 ♀ 14-3-30 Sankrametta, 3,500 ft.

Measurements:—

| | Bill. | Wing. | Tail. | Tarsus. |
|---|---|---|---|---|
| 6 ♂ | 13.5-15 | 72.5-82 | 34.5-38 | 12.5-13.5 mm. |
| 5 ♀ | 14-14.5 | 73-80.5 | 35-37.5 | 12.5-13.5 mm. |

This race of the Indian Pygmy Woodpecker is confined in the Presidency to the eastern side where the above series provides the only evidence as to its distribution in addition to Jerdon's statement that it occurs in Goomsoor. In Salem district Mr. LaPersonne says it was fairly common both in the hills and in the plains. In Vizagapatam district he also states that it was fairly common in the wooded parts at Sankrametta at 3,500 ft. It was evidently then breeding as birds were seen carrying food in April.

In the *New Fauna*, vol. iv, Mr. Stuart Baker considers that all the forms of Pygmy Woodpecker found in the limits of his work should be treated as races of one species. I prefer to divide them into two species namely *Dryobates nanus*, with races *nanus*, *semicoronatus* and *canicapillus*, and *Dryobates hardwickii* with races *brunneiceps*, *hardwickii*, *cinereigula* and *gymnophthalmus*. It appears to me that the plumage characteristics of these two groups are quite distinct *inter se*, that whilst there is complete intergrading between the members of each group separately there is no intergrading between the two groups, and finally it appears that in certain areas outside our limits both forms occur.

The type-locality of *hardwickii* is not the Wynaad as given by Mr. Stuart Baker (*New Fauna*, vol. iv, p. 52) but Goomsoor in Ganjam, the first of the two localities in Jerdon's account of his *Dendrocopus moluccensis* (Madras Jour. Lit. Sci., vol. xi, p. 213) for which later (*loc. cit.*, xiii, p. 138) he proposed the new name of *hardwickii*. Jerdon only mentioned the Wynaad to remark that his specimen from there was not the same as his *moluccensis*, later *hardwickii*, and this point is again referred to in the Birds of India, vol. ii, p. 279 and vol. iii, p. 871 (appendix) where this dark Wynaad specimen is identified as *gymnophthalmos* Blyth, synonym *P. cinereigula* Malherbe. All along this Wynaad bird is definitely contrasted with the true *hardwickii*. This initial mistake has thrown Mr. Stuart Baker out in his account of the distribution of the various races and made him overlook the existence of the very distinct Malabar-Travancore race. The existence of this race was recognised by Hargitt (British Museum Catalogue, vol. xviii, p. 331) but his name *Iyngipicus peninsularis* (Ibis 1882, p. 48) is antedated by *Picus cinereigula* Malherbe (Rev. et Mag. de Zool. Nov. 1849, p. 531). Malherbe says that he first discriminated this form from a specimen in the British Museum and his type is still there. It is a male labelled 'Madras' presented by 'H. H. Baber'. This last is a mistake for H. H. Baker, a clergyman correspondent of Blyth's who lived at Allepy in Travancore in the Madras Presidency.

The genus *Iyngipicus* is certainly not separable from *Dryobates* (see Ticehurst, J.B.N.H.S., xxxiv, p. 469).

## **Dryobates hardwickii cinereigula** (Malherbe).

*Picus cinereigula* Malherbe, Rev. et Mag. de Zool. Nov. 1849, p. 531—Madras = Alleppey, Travancore.

The Malabar race of the Indian Pygmy Woodpecker is confined to the western side of the Presidency. Betts says that it is fairly common in Coorg, often being found in the mixed hunting parties. It occurs in the Wynaad and on the lower slopes of the Nilgiris being found up to 3,000 ft. (William Davison) or occasionally 4,500 ft. (Betts). Col. Sparrow's collection contains two males killed at Malappuram. Fairbank met with two at Machur on the road between the Lower Palnis and Kodaikanal. In Travancore Ferguson says that it is found both in the low country and up to 2,000 ft. on the hills.

The statement that *D. h. gymnophthalmus* the Ceylon race occurs in extreme southern Travancore is based on two Anjango specimens in the British Museum. It must be remembered however that these Anjango specimens—of which there are examples of most Travancore species in the British Museum, semi-flat skins all of the same type and with the same data—cannot be accepted as evidence of distribution. Ferguson points out that the Shikaris of Anjango did a regular trade in bird skins and that the skins were brought there from other localities.

### **Micropternus brachyurus phaioceps** Blyth.

*Micropternus phaioceps* Blyth, J.A.S.B., vol. xiv (1845), p. 195—'India proper extending eastwards to Tipperah and Arracan', restricted type-locality Calcutta.

Specimens collected:—1401 ♂ 17-2-30, 1772-1773 ♂ ♀ 5-5-30 Anantagiri 3,000 ft.

Measurements:—

| | Bill. | Wing. | Tail. | Tarsus. |
|---|---|---|---|---|
| 2 ♂ | 27-30 | 121.5-123.5 | 61-62 | 21.5 mm. |
| 1 ♀ | 29 | 118.5 | 57.5 | 20.5 mm. |

These three specimens of the Rufous Woodpecker furnish the only record of this race within the Presidency. Nos. 1772-1773 were presumably a pair and by the state of the organs as noted on the labels were evidently just about to breed.

There has been of late years a good deal of discussion about the races of the Rufous Woodpecker (see in particular Kloss, Ibis 1918, pp. 107-109; Robinson, Ibis 1919, pp. 179-181; Stuart Baker, Ibis 1919, pp. 197-204). There is, we think, no particular difficulty in understanding the position with regard to the Indian Peninsula so long as one appreciates the fact that in India the differences of colour (dull to bright chestnut or bay), the amount of barring on the upper parts (virtually absent to fairly general) and the colour of the head (chestnut to dark brown) are mainly due to individual variation, whilst the character and colour of the squamation on the throat although a good racial characteristic in series is also individually reliable—as in the case of the throat markings in *Brachypternus benghalensis*. Size is of importance but the races grade into each other in this respect.

On the evidence at present available the distribution of the Rufous Woodpecker in India falls into two separate areas with a wide gap between them. In the southern area it is found all down the west coast from Khandala to Travancore and Ceylon extending also to the Shevaroys. In the northern area it is found along the Himalayas from Dehra Dun to Assam and from Bengal southwards to the Balaghat, Chanda and Anantagiri.

In the southern area the squamation of the throat is dark chocolate and white throughout. There is, however, a regular increase in size from Ceylon to the Bombay Presidency. It has been customary of late years to divide these southern birds into two forms *M. b. jerdonii*=*gularis* and *M. b. lanka*. Kloss (Ibis 1918, p. 108) who named the latter form confined it to Ceylon. Stuart Baker (Ibis 1919, p. 204; *New Fauna*, vol. iv, p. 66) added South Travancore to Ceylon. The difference is only one of size.

It is very difficult to say on the specimens available whether it is worth while recognising two forms in this area, as the increase in size is doubtless gradual with no natural boundary anywhere to mark it.

15 specimens from Ceylon measure: 9 ♂ Bill 26-30, wing 115-122 mm.; 6 ♀ bill 25-28, wing 116-122 mm. Nine specimens from S. Konkan and N. Kanara measure:—4 ♂ bill 28-31, wing 127-130 mm.; 5 ♀ bill 28.5-31, wing 126-129 mm. These wing lengths do not overlap and such specimens as

I have seen from Travancore, the Nilgiris, Burliar, Calicut, Cannanore and the Shevaroys must clearly go with the smaller Ceylon birds. Seven birds from the Wynaad, on the other hand, are with one exception (♀ wing 123.5 mm.) large birds:—4 ♂ bill 28.5-30.5, wing 126-129 mm.; 2 ♀ bill 28-28.5, wing 126.5-128 mm. Anyone who desires to recognise two races here—and I at present see no value in it—will have to find a new name for the larger birds, as *jerdonii* and *lanka* clearly refer to the same (smaller) bird.

*Phaiopicus jerdonii* Malherbe, Rev. Mag. Zool. 1849 (November-December), p. 535—Indian Peninsula was described from specimens in the British Museum. Apparently he examined the specimens in London in 1845 and then gave them the manuscript name of *Picus phaiopicus*. At that date there were four specimens in the British Museum, namely two skins (♂ ♀) from 'Madras' presented by the Rev. H. H. Baber and two from 'Madras' from Sir Walter Elliot. Now only the pair of Baber birds in the Museum can be traced and none of Elliot's, though according to the catalogue there should be three of Baber's and one of Elliot's. As Malherbe described a male and female and Baber's are such it seems reasonable to accept them as the types. The Revd. H. H. Baber, the name of the donor, is of course merely a clerical error for the Rev. H. H. Baker, a correspondent of Blyth's who lived at Alipi (Allepey) in Travancore where no doubt the birds were collected. I therefore restrict the type-locality of Indian Peninsula to Travancore. Elliot's 'Madras' birds no doubt also came from somewhere on the lower western coast in or near Travancore.

For the northern area in India the *New Fauna* accepts three races. This is, however, evidently due to the error in the type-locality of *phaioceps* which is given as Arrakan. Blyth said his birds came from 'India proper, extending eastwards to Tipperah and Arracan'. From his catalogue we know that his only specimens when the description was published were a male and female from Calcutta and a female from Tipperah. This had already been pointed out by Robinson (Ibis 1919, p. 180) who states that the types have wings of 115 and 121 mm. I have seen no Calcutta specimens but birds from Sikkim, Duars, Assam, Bihar, Dacca, Tipperah, and Anantagiri and Chanda can certainly not be separated from Burmese and Tenasserim birds. Dr. Ticehurst gives me the following wing measurements of males:—15 ♂ Burma 125-132, 36 ♂ Tenasserim 114, 120-133, 21 ♂ Assam 119-130 mm. and such birds as I have seen from the other localities fall within those measurements. The squamation of the throat, chestnut and buff, however separates these birds from those of the extreme south of India and Ceylon. *M. b. mesos* Kloss, doubtfully accepted by Mr. Stuart Baker is therefore a synonym of *M. b. phaioceps*.

The large bird from the North-Western foothills of the Himalayas (7 ♂ bill 31.5-33, wing 129-144.5 mm.) is, however, a very good race, distinguished not only by its larger size, but by its paler upper parts and paler, rather grayer head. This race is called in the *New Fauna* by Kloss's name. *M. b. humei* (the type-locality is the Kumaon Bhabar not Rohilkand as given), I think correctly, and Robinson appears to have been wrong in considering (Ibis 1919, p. 180) that the correct name should be *M. b. blythii* Malherbe, Rev. Mag. Zool. (November-December), 1849, p. 534—Himalayas. This last is evidently a synonymy for *M. b. phaioceps*.

*Phaiopicus blythi* Malherbe was in reality a new name for *Phaiopicus rufinotus* (misquoted as *rufanotus*), a manuscript name written on the labels of certain specimens in the British Museum in 1845 (first described by Bonaparte in Consp. Gen. Av., i, p. 113, 1850).

In describing his *Phaiopicus blythi* in 1849 Malherbe (Rev. et Mag. Zool., p. 534) quoted as synonymous *Picus rufanotus* (Malherbe, antea 1845, British Museum), *Meiglyptes badius* (Hodgson, Cat. Nepal Birds) and *Micropternus phaioceps* (Blyth, J.A.S.B., xiv, p. 195). The type-locality is evidently Nepal and not Eastern Himalayas as given in the *New Fauna* since in 1849 there appear only to have been Hodgson's specimens for Malherbe to see in the British Museum. In 1843, 2 males and 2 females were received from Nepal (Hodgson) and early in 1845 one male, one female, and one juvenile were received from the same source and apparently no further examples till some years later. Malherbe described male, female and juvenile. The four males from Nepal now in the British Museum although pale in colour appear to be bleached. Their wings measure 126.5-130 mm.

### **Micropternus brachyurus jerdonii** (Malherbe).

*Phaiopicus jerdonii* Malherbe, Rev. Mag. Zool. 1849 (November-December), p. 535—Indian Peninsula, restricted to Travancore.

Specimens collected:—282 ♂ imm. 25-5-29, 265 ♀ 22-5-29, 280 ♀ 24-5-29 Shevaroy Hills 4,000-4,500 ft.

Measurements:—

| | Bill. | Wing. | Tail. | Tarsus. |
|---|---|---|---|---|
| ♂ imm. | 23.5 | 123 | 63 | 23 mm. |
| 2 ♀ | 29 | 122.5 | 61 | —mm. |

On the eastern side of the Presidency, the Rufous Woodpecker is only known to occur on the Shevaroy Hills about 3,000-4,500 ft. where according to Mr. LaPersonne the species is well-distributed, and invariably found wherever there were old silver oak and rubber trees.

On the west it is fairly common in Coorg (Betts). It occurs, though nowhere numerous, in the Wynaad and on the slopes of the Nilgiris and William Davison remarks that he obtained one specimen a few miles from Ootacamund though this was exceptional. Specimens from Cannanore and Calicut are in the British Museum. This Woodpecker does not seem to have been recorded from the Nelliampathies or the Palnis. In Travancore, according to Ferguson it is only seen in the low country and at the foot of the hills.

### **Brachypternus benghalensis puncticollis** (Malherbe).

Specimens collected:—129 ♀ 25-4-29, 154 ♂ juv. 29-4-29 Kurumbapatti; 281 ♂ 24-5-29 Shevaroy Hills 4,000 ft.; 338 ♂ juv. 5-6-29, 339 ♂ juv. 340 ♀ 349 ♂ 6-6-29 Chitteri Range 2,000 ft.; 863 ♀ 2-10-29 Seschachalam Hills 2,000 ft.; 1029 ♂ 24-11-29 Nallamalai Range 2,500 ft.

Measurements:—

| | Bill. | Wing. | Tail. | Tarsus. |
|---|---|---|---|---|
| 3 ♂ | 34.5-41 | 140-146 | 82.5-87.5 | 25-26.5 mm. |
| 3 ♀ | 37 | 137-145.5 | 86.5-92 | 24.5-26 mm. |

Although the Golden-backed Woodpecker is recorded from Jeypore (Ball, S.F., vii, 206) I have seen no specimen from north of Rajamundry whence a skin in the British Museum collected by Blanford on 1st June 1871 is attributable to this race. Southwards on the eastern side of the Presidency a young male obtained by Wardlaw Ramsay in 1876 at Madras and now in the British Museum supplies the only record other than those furnished by the Survey. In Salem district LaPersonne remarks that it was common over the whole area from the foot of the Shevaroys to the Chitteri Range and Tirthamalai. Westwards it is found to the base of the Nilgiris whence came Malherbe's type. The type-locality of Ceylon given in the *New Fauna* (vol. vii, p. 314) is wrong.

Along the Malabar side it is replaced by the next form.

The races of the Golden-backed Woodpecker are somewhat difficult to make out as there is a good deal of individual variation, which leads to occasional specimens within the area of one form tending to vary in the direction of the characteristics of another form. The red fringing to the feathers found in a greater or less degree on the golden upper parts of many specimens in India has no racial significance beyond the fact that it apparently never occurs in the desert race *dilutus*.

We recognise the follownig races, but it is not yet possible to give their full distribution accurately:—

#### **Brachyternus benghalensis benghalensis** (Linnaeus).

*Picus benghalensis* Linn., Syst. Nat., ed. x, vol. i (1758), p. 113—Bengal.[1]

Upper parts rich golden-yellow; rump black; shoulder black with conspicuous creamy white spotting; chin, throat and breast black, streaked with white; white of lower parts pure.

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[1] Based on Albin, vol. iii, pl. 21, where the specimen is said to have been brought from Bengal in 1737 and to be in the possession of Mr. Dandridge.

Assam, Bengal, Bihar, United Provinces, Upper Punjab, Central India, Central Provinces and Orissa.

**Brachypternus benghalensis dilutus** Blyth.

*Brachypternus dilutus* Blyth, Cat. Birds. Mus. Asiat. Soc. (1852), p. 56—Scinde.

Upper parts a pale golden-yellow with, in a series, an impression of fine white spotting and dark flecking; rump black; shoulder black with conspicuous white spotting; chin, throat and breast white, streaked with black; white of lower parts pure.

Sindh, Mt. Aboo; birds from the lower Punjab are intermediate between this and *benghalensis.*

**Brachypternus benghalensis puncticollis** Malherbe.

*Picus* (*Brachypternus*) *puncticollis* Malherbe, Rev. Zool. 1845, p. 405—India, restricted to slopes of Nilgiris.

Upper parts golden-yellow, intermediate between the above two forms; rump black; shoulder partly black with conspicuous creamy-white spotting; chin, throat and breast black, with small white triangular spots; white of lower parts pale creamy white.

South India, excluding the range of the next form, up to the River Godavery. Birds from Eastern Hyderabad are intermediate between this and *benghalensis.*

**Brachypternus benghalensis tehminae** Subsp. nov.

Upper parts rich golden-olive yellow; black of rump much restricted and obscured by an olive wash; black of shoulder practically obscured by a golden-olive wash, the spots small or obsolete and yellowish cream in colour; chin, throat and breast black with fine white spotting and barring; white of lower parts with a creamy buff tinge.

West Coast from Malabar to Travancore. Type ♂ no. 475 Travancore Survey Coll. 20 March 1933 Rajampara 1,350 ft., Panthalam Hills. Collected by Mr. Salim A. Ali. (Presented to the British Museum).

**Brachypternus benghalensis intermedius** Legge.

*Brachypternus intermedius* Legge, Stray Feathers, vol. iv (December 1876), p. 242—Ceylon.

Very similar to *B. b. puncticollis* but more washed with olive on the mantle; the pale spots on the wing coverts are much smaller and it is altogether a smaller bird with a lighter bill.

Ceylon.

*Note.—Picus ceylonus* Cuvier, Règne Anim., vol. i (1829), p. 451, is erroneously used for this race in the *New Fauna.* It is based on a description, apparently by Forster, in Der Naturforscher, vol. xiii (1779), pp. 14-15, plate iv, which evidently refers to the red bird already described by Vieillot as *Picus erithronotus.* The bird described was a female and is said to have come from Legationsrath Meuschen.

*Brachypternus erithronotus* (Vieillot) should be treated as a separate species.

### **Brachypternus benghalensis tehminae** Subsp. nov.

This race of the Golden-backed Woodpecker is confined to the plains and lower slopes of the hills. In Travancore it is common in the plains as for instance about Trivandrum. Fairbank found it common in the heavy forest of the Lower Palnis. Kinloch recorded it as very common in the Nelliampathies. William Davison says that it is not uncommon about the base of the Nilgiris and in the better wooded parts of the Wynaad. There are 5 specimens from Calicut (Haines) in the British Museum.

There appear to be no published records of the breeding season in this area.

### **Dinopium javanense malabaricum** Nom. Nov.

This form of the Common Golden-backed Three-toed Woodpecker is confined to the west of the Presidency and so was not met with by the Survey. Here it is most common in the hills of Travancore where it is said by Ferguson to be one of the most common of all birds though not met with in the low country. It has not been recorded from either the Palnis or Nelliampathies and in the Nilgiris it is certainly less common, occurring up to 5,000 ft. William Davison considered it uncommon in the Wynaad but in Coorg Mr. Betts tells me that it is very common round Mercara in woodland country, often joining the mixed hunting parties.

Further north beyond our limits it extends as far as North Kanara.

I find no evidence for the statement that this race occurs in Orissa (*New Fauna*, vol. iv, p. 74). The only record of any form of Golden-backed Three-toed Woodpecker in this area is in Blyth's catalogue no. 253 where a specimen of *Tiga* (*Dinopium*) *shorei* is listed from Gumsoor in Ganjam.

This raises the point whether the name *Picus rubropygialis* Malherbe, Rev. Zool. (November-December), 1845, p. 400, can possibly refer to this race. Malherbe himself said that he had only seen a single specimen and that a mounted female which came from Bengal. Jerdon's statement (B. of I., i, p. 299) that the type came from Bangalore is of course merely a *lapsus calami*. There is in the British Museum a specimen that is probably the type. It is a dismounted female, said to be from India and presented by Mr. J. Inskipp. It was in the collection prior to 1837 and was still the only specimen of its kind at the date of Gray's Catalogue of 1868. This specimen is certainly neither the South Indian nor the Himalayan form but evidently agrees with the typical race. If it is the type—and the presumption is strong—India must mean the East Indies and refer to the far east, as is so often the case in these early descriptions, and *rubropygialis* Malherbe is a synonym of *javanense*. In any case the South-West Indian form is left without a name so for it I propose

**Dinopium javanense malabaricum**

Type ♂ 23-4-1881 Manantoddy, Wynaad. Collected by William Davison. In the British Museum, Register No. 1887.8.10.2019.

It differs from the typical race in being duller and darker with a more olive wash in the golden colour of the upper parts. In size it is larger, wing ♂ 135-142, ♀ 137.5-139 mm. The olive wash also separates it from the Burmese bird *D. j. intermedium* compared with which it is somewhat smaller.

### **Chrysocolaptes festivus** Boddaert.

*Picus festivus* Boddaert, Table Pl. Enlum. (December 1783), p. 43 for Pl. Enlum, 696—Goa, India.

Not met by the Survey. As in most parts of India, the Black-backed Woodpecker is rare in the Presidency. I do not know where Jerdon was referring to when he said (B. of I., vol. i, p. 283) that he had found it in the jungles of the Eastern Ghats. Hume said (S.F., x, 355) that he had received it from the northern bases of the Nilgiris and there are two Nilgiri specimens in the British Museum, namely a male with no precise locality dated 8 June 1875 (Watkins) and another male dated September 1876 from the Coonoor Ghat (Wardlaw-Ramsay). The *New Fauna* states that the Revd. Howard Campbell took an egg in the Nilgiris on 28 January.

The statement, also in the *New Fauna*, that Stewart took an egg in Travancore on the 4th February provides the only record that I have traced for that State.

It was unnecessary (*New Fauna*, iv, 77) to cite the analogy of *C. strictus* in order to suggest that the young have the crown black, spotted with white. Bell (S.F., ii, p. 391) and John Davidson (S.F., x, 279) had already recorded that the crown and crest of the young are yellow tipped with red or flame-coloured, presumably a sexual difference, and this is corroborated by a newly fledged bird from Raipur in the Hume collection.

I have not seen proper material from Ceylon to settle the question whether Ceylon birds are separable. They are said by Legge to be smaller with weaker beaks.

### **Chrysocolaptes guttacristatus guttacristatus** (Tickell).

*Picus guttacristatus* Tickell, J.A.S.B., vol. ii (after December 1833), p. 578—Borabhum.

Specimen collected:—1479 ♀ 5-3-30 Sankrametta 3,500 ft.

Measurements:—

| Bill. | Wing. | Tail. | Tarsus. |
|---|---|---|---|
| 50.5 | 109 | 91 | 32 mm. |

Tickell's Golden-backed Woodpecker was not common in the Vizagapatam district. A few pairs were seen.

This is the only record for the Presidency and it is evident that we are here on the southern limit of the typical form.

### **Chrysocolaptes guttacristatus chersonesus** Kloss.

*Chrysocolaptes strictus chersonesus* Kloss, Ibis 1918, p. 113—(Singapore Island).

This race of Tickell's Golden-backed Woodpecker is distributed along the West Coast of India and so was not met by the Survey. It is common in the Presidency and like all others of our Woodpeckers is strictly resident.

In Coorg it is much the commonest and most conspicuous Woodpecker as Mr. Betts tells me that his record to that effect under *Brachypternus benghalensis* (J.B.N.H.S., xxxiii, p. 548) should really refer to this species. In the Wynaad, William Davison considered it not uncommon. It is common on the slopes of the Nilgiris and occurs in smaller numbers on the plateau. In the Nelliampathies and the Palnis, it is common, occurring in the latter hills from top to bottom. Kinloch gives us a note about its roosting habit (J.B.N.H.S., xxiii, p. 546). In Travancore it seems to be less common. Bourdillon (S.F., iv, 389) says that it inhabits the lower ranges of forest. Ferguson, however, says that he has shot it at 3,000 ft. and also 6,000 ft. on the High Range, usually in the neighbourhood of streams. A female collected by Mr. Prater at Madura is in the Society's collection.

In Coorg, Betts says that the young hatch about the first week of March. In the Nilgiris according to William Davison and Darling, December, January and February are the breeding season (N. & E., ii, 313) and Howard Campbell took eggs in March near Ootacamund (*New Fauna*, vol. iv, p. 81).

It is quite certain that the name *Indopicus delesserti* Malherbe, Mem. Acad. Metz., vol. xxx (1849), p. 343, commonly used for the South Indian race cannot properly refer to it. The type-locality is not Malabar as given in the *New Fauna,* vol. vii, p. 317, but simply 'L'Inde' and it is evident from a perusal of Malherbe's descriptions that he was not referring to the South Indian form at all. He says that he had only seen two specimens, both females, of which the actual locality was not precisely known. These two birds are contrasted in the description with *sultaneus* and *strictus*. This latter name Malherbe applied to the South Indian bird of which he said he had received several examples from Jerdon who stated that they were found commonly in Malabar and South-East India.

M. Berlioz informs us that a pair of Woodpeckers, not 2 females, in the Paris Museum are believed to be the types of Malherbe's *delesserti*. Both measure approximately the same, viz.:—bill from frontal feathers 43 mm., wing 172-173 mm. This is too big for the South Indian form (wing ♂ 149-159, ♀ 147-158 mm.) and agrees roughly with a measurement of 170-180 mm. for the folded wing as given in Malherbe's description. Hume has already suggested (S.F., viii, 154) that Malherbe's birds were probably from the somewhat intermediate zone of Burma, and the name *Indopicus delesserti* Malherbe must be considered as a synonym of the typical form.

What name should take its place? Mr. Stuart Baker says (*New Fauna*, vol. iv, p. 81) that he cannot separate South Indian birds from others from Peninsular Burma and Siam and Malaya which have been named *indomalayicus* (type-locality Junk-Seylan) by Hesse and *chersonesus* (type-locality Singapore Island) by Kloss. Kloss has shown that the former name is a synonym of the typical form (Ibis 1918, p. 112). The latter race appears to be based entirely on size and I can see no colour difference. No proper series has been available for examination but Robinson and Kloss give the range of measurement for both sexes as 142-150 mm. [J.N.H.S. Siam, vol. v, No. 2 (October 1923), p. 196]. Ten birds (5 ♂ 5 ♀) measured from S.-W. India have wings 147-159 mm. This slight discrepancy seems hardly worth recognition and would doubtless disappear if a larger series from both localities were compared. I have no doubt that in this species we have another example of the fact that birds at the extremities of the horse-shoe Ceylon, India, Burma and Malaya are alike and therefore propose to use the name *chersonesus* for the S.-W. Indian bird.

### **Hemicircus canente cordatus** Jerdon.

*Hemicircus cordatus* Jerdon, Madras Jour. Lit. Sci., vol. xi (1840), p. 211—Malabar.

Not obtained by the Survey. The Heart-spotted Woodpecker is confined to the western side of the Presidency where it is fairly well-known. In Coorg it is certainly rare but Mr. Betts tells me he has met with it on two occasions. It is sparingly distributed throughout the Wynaad and more commonly on the western slopes of the Nilgiris up to 3,000 ft. (William Davison) or 4,500 ft. (Betts). There are 3 birds from Calicut in the Hume collection. Further south it is commoner, both in the Nelliampathies (Kinloch) and in Travancore where it is found both in the low country and on the hills.

The only breeding records in our area are from Travancore. Mr. C. Primrose took single eggs on November 26th and December 15th (J.B.N.H.S., xxxv, 207) and Bourdillon (S.F., iv, 389) found it excavating in February. Mr. Stewart found it breeding from January to March (*New Fauna*, iv, 85).

The range on the west is rather more extensive than the *New Fauna* makes clear. Not only did Laird obtain it in N. Kanara, as stated, but so did Bell and John Davidson found that it occurred both above and below ghats in that district and Aitken took eggs near Castle Rock on 10 January (J.B.N.H.S., xi, 679). Laird also obtained it in the Forests west of Belgaum (S.F., ix, 385) and Butler (S.F., v, 503) shot the female of a pair at Khandala.

Both sexes bear tufts of bristly feathers in the middle of the back, which are usually covered with a gummy substance, which has a very strong peculiar, somewhat resinous but decidedly pleasant smell. Both the viscidity and the scent completely disappear after the specimen has been preserved a short time (William Davison, S.F., vi, 127). Nothing is known of the purpose of this unusual feather, and whether it is seasonal or not. The point may be commended to observers for investigation.

### **Macropicus javensis hodgsoni**

*Hemilophus hodgsonii* Jerdon, Madras Jour. Lit. Sci., vol. xi (1840), p. 215, pl. ii—Malabar.

The Malabar Great Black Woodpecker is confined in the Presidency to the western side where it is somewhat local in distribution and dependent on the condition of the forest areas. Jerdon tells us that he saw it in Coorg and at the foot of the Peria Pass. It is not uncommon in the Wynaad according to William Davison. In the Lower Nilgiris it is apparently very scarce and local according to Mr. Betts and Davison once obtained it in Bamboo-jungle near Goodalore. In the Nelliampathies it is common and there Kinloch wrote a series of notes on its habits and breeding (J.B.N.H.S., xxvii, p. 941; xxix, pp. 294 and 561). In Travancore Ferguson says that it is confined to the forests between 500 ft. and 3,000 ft. elevation.

According to Kinloch the eggs are laid about the end of January in the Nelliampathies.

For the mistakes in the *New Fauna* over the specific name of this bird, see Ticehurst, J.B.N.H.S., xxxvi, 933. The specimen described by Jerdon was sent to him by Mr. Vaughan the Circuit Judge at Tellicherry.

### **Vivia innominatus malayorum** (Hartert).

*Picumnus innominatus malayorum* Hartert, Vog. Pal. Fauna, vol. iii (1912), p. 937—Perak.

Specimens collected:—1445 ♂ 26-2-30 Anantagiri 3,000 ft.; 1476-1477 ♀♂ 5-3-30; 1632 ♀ 31-3-30 Sankrametta 3,000-3,500 ft.

Measurements:—

| | Bill. | Wing. | Tail. | Tarsus. |
|---|---|---|---|---|
| 2 ♂ | 11.5-12 | 57.5-59.5 | 30-32 | 12 mm. |
| 2 ♀ | 11-11.5 | 58-59.5 | 30-31 | 12-13 mm. |

Mr. LaPersonne says that these Speckled Piculets were not uncommon at Anantagiri and Sankrametta and it was evident from the organs that they were breeding in March. The courtship consisted in the male pursuing the female round and round the branch of a tree in little jerky movements, always working downwards.

The discovery of this species in the Vizagapatam area was one of the surprises of the Survey as the species was within India hitherto only known from the Himalayas from Hazara to Upper Assam and in South-West India from N. Kanara to Travancore. The series obtained by the Survey cannot be separated from Burmese-Malayan birds.

### **Vivia innominatus avunculorum** (Hartert).

*Picumnus innominatus avunculorum* Hartert, Vog. Pal. Fauna, vol. ii (1912), p. 937—Kotagherry, Nilgiris.

In South-West India the Speckled Piculet seems to be very rare. The *New Fauna* (vol. iv, p. 94) gives the range as the Nilgiri and Wynaad Hills, Agrore and Travancore Hills. Leaving aside the fact that Agrore is in Hazara, N.-W. Himalayas, this distribution overlooks the fact that the bird has been recorded as far north as N. Kanara (John Davidson, J.B.N.H.S., xi, 679).

In the Presidency the bird was first recorded from the Wynaad where it was obtained by Mr. Darling on the 8th July 1877 (Hume, S.F., v, p. 351). This specimen is in the British Museum and a second obtained in the Wynaad by Mr. J. P. Cook on 1st January 1894 is in the Society's collection. The type of *avunculorum*, a male obtained on 14 March 1881 at Kotagherry is in the British Museum. Mr. Betts informs me that he has once or twice seen a pair in the Ochterloney Valley and that they were active and restless in behaviour. In Travancore, Ferguson states (J.B.N.H.S., xii, p. 203, and xv, p. 656) that he shot one and saw another at 4,000 ft. in heavy jungle at Chimunji. Stewart has also obtained it in Travancore according to the *New Fauna.*

I have only been able to examine 4 specimens of this race and on them should have had considerable hesitation in separating this race from *V. i. malayorum*, which takes page precedence. Dr. Hartert however in his description is so emphatic that this race is recognisable at the first glance and indeed almost merits recognition as a full species, that I deem it better to be guided by his decision until further material is available.

### **Jynx torquilla** Linnaeus.

*Jynx torquilla* Linnaeus, Syst. Nat., ed. x (1758), p. 112—Europe; restricted type-locality Sweden.

The *New Fauna* (vol. iv, p. 99) states that the typical race of the Wryneck occurs in the greater part of India but particularly on the western side and in Southern India and (p. 100) that *Jynx torquilla japonica* occurs in the greater part of Eastern India as far south as Madras. The evidence for these statements is—so far as our Presidency is concerned—unknown to me. Jerdon states that he obtained the Wryneck at Nellore and Madras (B. of I., vol. i, p. 304) and Dewar, probably on this evidence, says that it is 'Not at all common at Madras' (J.B.N.H.S., xvi, p. 491). There is one old specimen from 'Madras' in the Gould collection in the British Museum. The species was not obtained by the Survey and I have no other information regarding it.

(*To be continued*).

# THE GAME BIRDS AND ANIMALS OF THE MANIPUR STATE WITH NOTES OF THEIR NUMBERS, MIGRATION AND HABITS.

BY

J. C. Higgins, i.c.s.

## Part VI.

(*Continued from page 95 of this volume*).

### Quails.

Five species of quail reside and breed and two migratory species have been recorded, but are most uncommon. There are not sufficient quail anywhere to make it worth while to go out after them alone. A few are bagged out snipe or partridge shooting, but many sportsmen let most of them go as not being worth powder and shot. The best bag is 110, in 1915-16. The Manipuri name for all the quails is *sorbol*, irrespective of species. The name is sometimes corrupted to *soibol*.

**The Japanese Grey Quail** (*Coturnix coturnix japonica*).

One specimen is recorded as having been shot in Manipur in 1899.

**The Common or Grey Quail** (*Coturnix coturnix coturnix*)—Manipuri, *sorbol*.

This species is rare in Manipur, as it is in Assam: as Baker[1] says, it only 'struggles into that province'. Further, the variation in the numbers seen from year to year is considerable. In some years a fair number are bagged, while in others not a single one is flushed. The same seems to be true of the Assam valley. In 1920-21, the first year I was in Nowgong, I bagged 15: in 1921-22 and 1922-23 I never saw one. The earliest recorded in Manipur was shot on September 3rd (1919) and the latest on April 20th (1919), but these are the only records in September and April. Only 80 have been shot since 1910, the best year being 1916-17, when 17 were bagged. The best days were:—

| | |
|---|---|
| 10-3-17 | ... 5 |
| 19-1-26 | ... 4 |

Being always on the lookout for *C. c. japonica*, and not being entirely certain of my identification, I submitted a single skin to the Society in 1916, followed by a small series in the next year. With reference to the single skin, Mr. Millard wrote:—

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[1] Op. cit., *J.B.N.H.S.*, vol. xxix, No. 3, p. 583.

> 'It is a very difficult matter to say exactly which species this is. It does not tally exactly with either the description of *japonica* or *communis*. So far as we can ascertain, the specimen sent is mid-way between these two species, having points of resemblance to both. . . . It is probable they interbreed and on the border line where the two species meet one would find birds grading into either *japonica* or *communis*.'

and later:—

> 'In Japan and China *coturnix communis* during the breeding season occupies the same tract of territory as *c. japonica* and there is no doubt that all sorts of hybrids are produced.'

With regard to the series he wrote:—

> 'The quail are all *Coturnix communis japonica*, as they undoubtedly would be, situated as you are on the border line of these two species.'

I have always examined my Grey Quail carefully, and most of the specimens I have shot appear to be intermediate between the two races, though some approximate very closely to *C. c. coturnix*. The throat feathers are only slightly, not definitely lanceolate: but the reddish tint of the throat and flanks is very noticeable, in comparison with the typical Grey Quail. But I have never found a specimen which was sufficiently close to the description of *C. c. japonica* to make it worth while sending the skin for identification, on suspicion of its belonging to that species. The true *japonica* must be very rare indeed in Manipur.

Baker[1] refers to 'breeding birds being found as far east as Manipur'. He does not quote his authority for this statement, and I have no confirmation of its breeding, unless the bird shot in April can be taken as such: but this does not seem to be very conclusive evidence.

**The Indian Blue-breasted Quail** (*Excalfactoria chinensis chinensis*)—Manipuri, *sorbol*.

As Baker[2] remarks, 'this species is very common in Manipur'. At the same time, it is only found in small parties, and I have only once seen them sufficiently thick to allow of anything like a 'bag' being made—on March 22nd, 1916, when we shot 13 and could have shot more. The next best bags were 8, on January 10th, 1916, and January 19th, 1919. The best year's bag is 68, in 1915-16. In the hills I have never found them plentiful, even where the terrain is suitable. They like wetter country than most of the quails and are frequently put up on grazing grounds at the end of the rains, when snipe shooting, and occasionally in bogs, especially in the spring. As a table bird they are far superior to the Grey Quail.

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[1] Op. cit., *J.B.N.H.S.*, vol. xxix, No. 3, p. 580, and *Fauna of British India*, vol. v, p. 373.

[2] Op. cit., *J.B.N.H.S.*, vol. xxix, No. 1, p. 4.

**The Manipur Bush Quail** (*Cryptoplectron manipurensis manipurensis*)—Manipuri, *sorbol amubā* ('the black quail'): I have never heard it called *lāng sorbol* ('the snare-quail').[1]

This sporting little bird appears to be getting scarcer, as the last 13 years have only produced 93 birds—the same number as the four seasons 1915-16 to 1918-19. The decrease is probably due to increasing population and the consequent spread of cultivation. None have been shot in the past two years, and I have not even seen one. The best year is 1918-19, when 42 were shot. Good days were:—

| | |
|---|---|
| 24-3-26 | ... 17 |
| 10-3-17 | ... 14 |
| 19-3-29 | ... 13 |

Hume's[2] failure to flush them by burning the grass is not surprising. Partridges very rarely fly out of burnt grass and quails never, probably from fear of the hawks which hover round, eating the insects. The birds break out at the edges and run to the nearest cover. Inglis[3] has remarked this characteristic, in his notes on *C. m. inglisi.*

There is nothing to add, regarding their habits, to the notes recorded in the Journal by Baker and Inglis (referred to above), and by Connor.[4] I have seen these birds in the bogs and swamps in the south of the valley and also in the glens which run into it.

**The Burmese Bustard-quail** (*Turnix suscitator plumbipes*)—Manipuri, *sorbol.*

Fairly common, both in the valley and in the hills, in suitable localities, but nowhere really plentiful. The best year's bag is 18, in 1917-18, and good days were:—

| | |
|---|---|
| 22-3-25 | ... 9 |
| 5-3-18 | ... 7 |

This bird, like the other button-quails, is better eating than the Grey Quail.

**The Little Button-quail** (*Turnix dussumieri*)—Manipuri, *sorbol.*

This bird is not common, but occurs in suitable localities, as Baker[5] says, 'mostly in fairly wide stretches of *sun*-grass, not necessarily very long or very dense'. I have also shot it on grazing grounds with very little cover. The best year's bag was 7 in 1925-26. Only 18 have been bagged altogether, but, like the other small quail, they are sometimes allowed to go unmolested.

**The Burmese Button-quail** (*Turnix maculatus maculatus*)—Manipuri, *sorbol.*

This species is very scarce. It has been recorded on 13 occasions only, but personally I have only seen it five times in 17 seasons, and cannot vouch for the identification of the other eight being correct. Indeed, it is almost certainly not so: many sportsmen call the Blue-breasted Quail a 'button-quail', on account of its small size, and as that species has yellow legs, it is, I know, sometimes classified as this bird in error. Of my five birds, four were obtained in the Manipur valley and one in the Jiri valley, on the Cachar border. I have never seen it in the hills. The identification of the Manipur bird as *T. m. maculatus* and not *T. m. tanki* was confirmed by the Society, and it was remarked that the specimen sent 'differed slightly from the Burmese specimens, being darker'.

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[1] *Fauna of British India*, vol. v, p. 383.

[2] Baker, 'Game Birds of India, Burma and Ceylon', *J.B.N.H.S.*, vol. xxix, No. 4, p. 858.

[3] *J.B.N.H.S.*, vol. xix, No. 1, p. 3.

[4] *J.B.N.H.S.*, vol. xviii, No. 2, p. 496.

[5] *Game Birds of India, Burma and Ceylon*, vol. iii, p. 34.

### Pigeons and Doves.

Doves of various species are common in the Manipur valley: pigeons are fairly common in the hills, but very rare in the valley. Consequently, the Manipuri has different names for the doves, but does not distinguish between the various species of pigeon and lumps them all together under the term *lam khunu* ('wild pigeon') or *ching khunu* ('hill pigeon'). Only 83 pigeons have been shot since 1916, many of them in the Kabaw valley of Burma, where they are plentiful.

**The Bengal Green Pigeon** (*Crocopus phœnicopterus phœnicopterus*).

Baker[1] says that south of the Naga Hills (which lie immediately north of Manipur) this species and the Burmese race (*C. p. viridifrons*) overlap. In the plains of the Surma valley, immediately to the west, which he knew well, he ascribes the birds to an intermediate type, tending towards *viridifrons*. I have never seen any of either species in Manipur itself, though I have no doubt they occur. But I have shot them on several occasions in the Kabaw valley, just across the Burma border, where they are plentiful, and all the specimens I have examined appeared to fall under the description of *phœnicopterus*. This identification was confirmed by the Society in the case of a specimen sent up in 1916. It may be noted that, while Wickham[2] speaks of *viridifrons* as common in the Upper Burma hills, Hopwood and Mackenzie[3] classify the bird of the northern Chin Hills, which adjoin both Manipur and the Kabaw valley, as *phœnicopterus*.

**The Ashy-headed Green Pigeon** (*Dendrophasa pompadora phayrei*).

This species is fairly common in the hills. I shot a single bird in a village on the west edge of the Manipur valley, about 2 miles from the foot of the hills, on February 5th, 1915. Mrs. A. A. Barnard saw a few in Imphal in July, 1932. Three green pigeons, unidentified but probably of this species, were shot near the foot of the eastern hills on March 8th, 1920.

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[1] *Indian Pigeons and Doves*, pp. 8, 18.
[2] *J.B.N.H.S.*, vol. xxxiv, No. 2, p. 340.
[3] *J.B.N.H.S.*, vol. xxv, No. 1, p. 90.

**The Thick-billed Green Pigeon** (*Treron curvirostra nipalenis*).

This species is not uncommon in the hills. On March 23rd, 1918, I saw a number of flocks in the jungle surrounding a village in the eastern hills, at 4,200 ft. There was no doubt as to the identification, as a sepoy shot one the previous evening.

**The Pin-tailed Green Pigeon** (*Sphenocercus apicaudus*).

This species is not uncommon and has been shot in the hills.

**The Orange-breasted Green Pigeon** (*Dendrophasa bicincta bicincta* or *prætermissa*).

Mr. A. A. Barnard, I.S.E., saw a pair at Kanglatongbi, at the foot of the hills in the north of the valley, in July, 1932.

**The Wedge-tailed Green Pigeon** (*Sphenocercus sphenurus sphenurus*).

I have never seen or heard of this species in Manipur, though from Baker's[1] description of its habitat there seems to be no doubt that it must occur.

**The Green Imperial Pigeon** (*Muscadivora ænea sylvatica*).

Baker[2] says that this species is 'a bird of the hills and plains alike . . . in Assam and Burma'. It does not occur in the Manipur valley and I have never seen it in the hills. But it is common in the Kabaw and Jiri valleys, on the Burma and Cachar borders of the State, and also in the Nambar forest, at the foot of the Naga Hills on the north.

**The Grey-headed Imperial Pigeon** (*Ducula badia griseicapilla*).

Baker[3] rightly says of the Manipur birds that 'though somewhat intermediate', they are nearest to *griseicapilla* and not to *insignis*. This species is fairly common in the hills, and one meets it frequently in *jhums*, on the march when one has no gun. I only once saw a large flock, of about 30, on November 22nd, 1931, in the south-western hills, at about 3,500 ft.

**The Bronze-winged or Emerald Dove** (*Calcophaps indica*).

This species is fairly common in the western hills, where it finds the evergreen forest which it likes. I have never noticed it in the eastern hills, though it may occur there.

**The Ashy Wood-pigeon** (*Columba pulchricollis*).

On July 17th, 1926, I saw three large grey pigeons (not the Grey-headed Imperial Pigeon) in a small thicket of mixed pine and evergreen forest, on the upper slopes of the high range west of the Manipur valley, at 5,100 ft. I heard the call of the same bird in the same place on July 2nd, 1927. From Baker's[1] description of their calls, it seems probable that these birds belonged to this species and were not the Speckled Wood-pigeon (*Dendrotreron hodgsoni*).

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[1] Op. cit., p. 82.

[2] Op. cit., p. 94.

[3] *Fauna of British India*, vol. v, p. 204.

**The Indian Rufous Turtle-dove** (*Streptopelia orientalis meena*)—Manipuri, *khunu chaphubi* ('the pot pigeon', alluding to the likeness of their colouring to that of a red earthenware pot, burnt blue in patches) or *leimā khunu* ('the goddess pigeon').

This species is fairly common. It frequents the Residency garden in flocks during the rains, beginning to appear about the end of May.

**The Malay or Burmese Spotted Dove** (*Stretopelia chinensis tigrina*)—Manipuri, *khunu hawaimān* ('the spotted pigeon').

Very common in the Manipur valley and lower hills. I have never examined them to see whether they are *tigrina* or *suratensis*. Baker[2] says that the Manipur birds are 'intermediate between *suratensis* and *tigrina*', but 'nearer the Burmese than the Indian form'.[3]

**The Burmese Ring-dove** (*Streptopelia decaocto xanthocycla*)—Manipuri, *khunu halamān* (Hindu), or *khunu gurumān* (Muhammadan): I am informed that these names are both derived from the sound of the bird's call.

This species is common in the Manipur valley, especially near the foothills. An albino specimen was shot by Mr. C. Gimson, I.C.S., on December 26th, 1925.

**The Burmese Red Turtle-dove** (*Oenopopelia tranquebarica humilis*)—Manipuri, *wā khunu* ('the bamboo pigeon'). It is curious that the term 'bamboo-pigeon' is applied to *Streptopelia orientalis meena* in Bengal,[4] as I can confirm.

These little doves are common in the Manipur valley. They are found in flocks on the grazing grounds at the end of the rains, and collect in very large parties in the cold weather. They are very fast fliers, and I have had excellent sport shooting them when driven over bamboos at the corner of a village.

**The Bar-tailed Cuckoo-dove** (*Macropygia unchall tusalia*).

I have only seen one in Manipur, in a glen off the Manipur valley in the south-west.

## II

## MAMMALS.

Big game is scarce in Manipur. The Manipur valley is too thickly populated and deforested to hold many wild animals. In the hills, the Kukis—the 'scourge of God' as far as wild animals are concerned, have completely killed off a number of species since they migrated northwards into the State a little over a century ago, and have greatly diminished the rest.

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[1] *Indian Pigeons and Doves*, pp. 158, 175.

[2] *Fauna of British India*, vol. v, p. 243.

[3] *Indian Pigeons and Doves*, pp. 205, 211.

[4] 'Vertebrates of Jalpaiguri District', (Inglis, Travers, O'Donel and Shebbeare), *J.B.N.H.S.*, vol. xxvii, No. 1, p. 153.

**The Elephant** (*Elephas maximus*)—Manipuri, *sāmu* ('the black animal').

The Elephant was formerly common in the hills, and the Maharajas used to run kheddahs: the last of which I can find any record appears to have taken place in 1872, when 21 were caught in the Leimatak valley, which is the next valley to the west from the Manipur valley. In 1913 I saw the skull of an elephant in the house of a Kuki Chief, which had been shot by him some years before in the valley of the Khuga river, which flows into the Manipur valley from the south-west. Now the only elephants in the State are a very few in the extreme north and north-west, adjoining the Naga and North Cachar Hills, and in the foothills adjoining the Kabaw valley of Burma, in the south-east. The only one recorded in the Game Book since 1910 was shot in the Kabaw valley, where they are fairly plentiful.

**The Javan Rhinoceros** (*Rhinoceros sondaicus*)—Manipuri, *sāmu gandā* ('black animal rhinoceros').

Now only found as an occasional straggler, the rhinoceros was formerly not uncommon in suitable localities in the hills. I saw a skull in 1913, in the house of a Kuki Chief, which he had shot in the valley of the Khuga river. In the past 20 years, 2 or 3 have been killed by Kukis in the lower valley of the Barak, near Tipaimukh, on the Lushai Hills border. These were probably stragglers from the North Lushai Hills. I have never had an opportunity of ascertaining with certainty to what species these belong, but they are probably *sondaicus*.

**The Gaur or Indian Bison** (*Bibos gaurus*)—Manipuri, *lamsan* ('wild cattle').

The bison was formerly found throughout the hills, but now occurs only in the mountainous forests of the headwaters of the Jiri and Makru rivers, near the North Cachar border, and in the foothills above the Kabaw valley. Tradition has it that a pair always resides in the wild uninhabited country on the lofty Laikot range, between the Barak and the headwaters of the Irang, in the north-western hills. Some years ago one wandered across the eastern hills from the Kabaw valley or Somra, into the valley of the Thoubal river, two marches east of Imphal. The bison is not very common, even in the Kabaw valley. Colonel Wilson[1] records that they 'had existed in the State in fair numbers, but were practically wiped out by foot and mouth disease in 1896'. No doubt the Kukis helped.

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[1] Op. cit., p. 182.

**The Gayal or Mithun** (*Bibos frontalis*)—Manipuri, *sandang.*

Lyddeker[1] says that 'there has been much discussion as to whether the Gayal or Mithun is a truly wild animal or only a domesticated breed'. There is, I think, no doubt whatever that it is the latter, derived from the Gaur, with a strain of domestic cattle. The Gayal is kept as a domestic animal by hill men throughout the Manipur State, as well as elsewhere in Assam and Burma. Notes regarding it were published in the Journal recently by Mr. Livesey[2] and myself[3]. Since then, I have seen an entirely white Gayal and have heard of another.

**The Bantin or Tsaing** (*Bibos banteng*)—Manipuri, *santhou.*

Lyddeker[4] claims that the Tsaing 'occurs in the Manipur district, especially in the Kubbu (Kabaw) valley, between Manipur and Northern Burma'. As a matter of fact, this species now only occurs in Manipur as a straggler in the foothills above the Kabaw valley, where it is plentiful. But this valley is now wholly in Burma, although it was a part of Manipur prior to 1834, when it was ceded to Burma. The Tsaing formerly penetrated further into the State, as in 1913 I saw a head in the house of a Kuki Chief, which he had shot some years before in the Khuga valley.

Lyddeker puts forward the theory that the 'Manipur Bantin', meaning the Kabaw valley animal, may be a distinct subspecies from the Burma Bantin. On this I can express no opinion, having had no experience of any but the Kabaw Tsaing, but the description of the Kabaw bulls given by Colonel Wood, which he quotes, is correct.

**The Indian Buffalo** (*Bubalus bubalis*)—Manipuri, *iroi* ('the swimmer').

The wild Buffalo does not occur at all in the Manipur State, and there is no historical record or tradition of its occurrence. I mention the animal because, as Lyddeker[5] quotes the Manipuri name, it might be inferred that the animal is found wild in Manipur.

**The Serow** (*Capricornis sumatrensis rubidus*). I can find no Manipuri name.

The Serow occurs throughout the hills. I have never shot one and have only seen one skin. But from enquiries it seems certain that only one form occurs—*C. s. rubidus.* This is confirmed by the observations of Moggridge[6] with regard to the Upper Chindwin, on the east, and of Mackenzie with regard to the Upper Chindwin[7] and the Chin Hills,[1] to the south. In the Naga Hills also, to the north, Mills[2] ascribes the serow to this subspecies.

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[1] *The Game Animals of India* (1924), p. 64.
[2] *J.B.N.H.S.*, vol. xxxv, No. 1, p. 199.
[3] *J.B.N.H.S.*, vol. xxxv, No. 2, p. 444.
[4] Op. cit., p. 73.
[5] Op. cit., p. 83.
[6] *J.B.N.H.S.*, vol. xix, No. 4, p. 981.
[7] *J.B.N.H.S.*, vol. xxii, No. 4, p. 790.

**The Goral** (*Nemorhaedus griseus*)—No Manipuri name.

This animal only occurs on three contiguous ranges in the south-western hills, Tonglon, Lungthul and Songchal (83 H, BC4) in the valley of the Tuivai river. Leddeker[3] gives no indication of which species occurs in Manipur, saying that *N. hodgsoni* is 'said to occur in the Naga Hills, and *N. griseus* in Upper Burma. Pocock[4] says that the Naga Hills specimen was probably *griseus*, to which subspecies he ascribes the Goral of the Lushai Hills to the south-west of Manipur and the Chin Hills to the south, which districts are only separated from the locality where the Goral is found in Manipur by the Tuivai river and its tributary, the Tuikui. I have never shot a Goral myself, but have seen them, including dead animals shot by Kukis. These appeared to correspond to the description of *cinereus*.

**The Sambar** (*Rusa unicolor*)—Manipuri, *sajan*.

The Sambar of Manipur, which is not uncommon in the hills and in the glens running off the Manipur valley, belongs to the subspecies named *equinus* by Lyddeker,[5] being of the Malay variety. The heads are, as a rule, not large, even for the Malay Sambar. I have seen two instances of abnormal horns, both brought in by hillmen. In the first, of which I have not preserved the measurements, the right horn was normal; but the left horn had five points, with a tine as long as the brow tine and between it and the beam, and also a tine as long as those of the crowning fork and between them. This head was unusually massive. The second is an extraordinary head, with six points on the right and four on the left horn. The length of the right horn is 25½ in., and of the brow tine 10⅛ in.; the forked tines at the end of the horn are short—1⅜ in. and 4⅞ in.; but inside the beam and the brow tine, growing from the burr, are a second beam, 18½ in., and a second brow tine, 4 in.; while between the main beam and main brow tine is a short sixth tine, 3⅝ in. The burr measures 12⅝ in. in circumference. The left horn measures 30¼ in. in length, with the rear tine of the fork 10½ in. and the front tine 15¾ in.; the brow tine measures 18¾ in.; halfway up the front tine of the fork, a tine of 3⅛ in. juts backwards towards the rear tine; there is a small rudimentary tine on the inside of the brow tine, not sufficiently large to count as a point; the burr is 11 in. in circumference, and the beam is 10⅜ in. in circumference just below the fork.

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[1] *J.B.N.H.S.*, vol. xxiv, No. 4, p. 762.

[2] *J.B.N.H.S.*, vol. xxix, No. 1, p. 228

[3] Op. cit., pp. 152, 154.

[4] *J.B.N.H.S.*, vol. xxii, No. 2, p. 316.

[5] Op. cit., p. 232

**The Hog Deer** (*Hyelaphus porcinus*)—Manipuri, *kharisā*.

This species is not uncommon in the swamps in the south of the valley, the grassy tracts at the foot of the hills surrounding the valley, and the glens running off it. The heads are small.

The Manipuri Muhammadans hunt the Hog Deer in bands, consisting of mounted men armed with polo sticks and men on foot armed with spears, accompanied by trained dogs.

**The Panolia or Eld's Deer** (*Rucervus eldi*)—Manipuri, *sangai*: not '*sangnai*' or '*sangrai*', as in Lyddeker[1] and Oldfield Thomas.[2]

This species is found in the swamps and bogs in the south of the Manipur valley, and nowhere else in the State; incidentally, the whole valley is not 'one huge swamp', as Lyddeker[3] says. In the swamps it is fairly common, but, although nominally preserved by law, its numbers have decreased in late years, owing to the attentions of wild dogs and poachers. In times of high flood the wretched animals are driven out of their haunts to isolated pieces of high ground, where the neighbouring Nagas and Muhammadans take heavy toll, regardless of sex, age, close season or the rules directing the taking out of licenses to hunt them.

The best heads shot since 1910 are those recorded in the Journal,[4] bagged by Major-General H. C. Tytler (52 and 53 in., including the brow-antler), and by Jemadar Bahadur Khan, 17th. Infantry (53¼ in.).

**The Muntjac or Barking Deer** (*Muntiacus muntjak*)—Manipuri, *saji*.

This species is very common throughout the hills, and is found also in the isolated low hills and ranges in the valley itself, wherever they are sufficiently wooded. I have never examined the Manipur animals, with a view to determining whether they are *vaginalis* or *grandicornis*. Lyddeker[5] puts them down as *vaginalis*, to which subspecies Mills[6] ascribes the Naga Hills specimens. But Wroughton[7] recoeds both subspecies as occurring in the Upper Chindwin district, *grandicornis* having been obtained from the Kabaw valley. It seems probable, therefore, that both may occur in Manipur.

**The Indian Wild Boar** (*Sus cristatus*)—Manipuri, *lamok* ('wild pig').

Pig are common in the hills. In the valley they occur in the grassy tracts along the foothills and in the swamps in the south.

**The Tiger** (*Felis tigris*)—Manipuri, *kei*, *keijao* ('big tiger').

Tigers are found throughout the hills, and very occasionally in the valley near the foothills. But they rarely venture far from the hills, as the Manipur valley is bare of forest, and, except in the swampy south, of heavy grass cover. Moreover, the Manipuris have an ancient organisation under which their villages are grouped into *keirups* or 'tiger-clubs', for the purpose of ringing and killing tigers as soon as they make their appearance.

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[1] Op. cit., p. 251.

[2] *J.B.N.H.S.*, vol. xxv, No. 3, p. 363.

[3] Op. cit., p. 253.

[4] *J.B.N.H.S.*, vol. xxi, No. 2, p. 655.

[5] Op. cit., p. 259.

[6] *J.B.N.H.S.*, vol. xxix, No. 1, p. 229.

[7] *J.B.N.H.S.*, vol. xxiv, No. 2, pp. 308, 309, and vol. xxiv, No. 4, p. 773.

Between 1910 and 1924 (when the system was abolished) rewards were paid to the hillmen for the destruction of 189 tigers.

**The Leopard** (*Felis pardus*)—Manipuri, *kabo kei* ('the Kabaw tiger').

Leopards are common throughout the hills and straggle into the low hills in the Manipur valley itself.

Between 1910 and 1924 rewards were paid to hillmen for the destruction of 595 leopards. Of these, about 380 passed through my hands, of which only 2 or 3 were black.

**The Clouded Leopard** (*Felis nebulosa*).

This animal occurs in the hills, but is uncommon.

**The Golden or Bay Cat** (*Felis temmincki*).

This cat also occurs in the hills, but is rarer than the previous species. I only remember seeing 2 or 3 brought in for the reward, in seven years.

**The Leopard Cat** (*Felis bengalensis*).

Not uncommon.

**The Fishing Cat** (*Felis viverrina*).

I have never seen this animal in Manipur, although it is fairly common in the Assam valley.

**The Jungle Cat** (*Felis chaus*)—Manipuri, *tokpā*.

Fairly common.

**The Civet Cat** (*Viverra zibetha*).

Rare; but a species of Palm Civet (*paradoxurus*), known in Manipuri as *moirāng sāthibi* ('the dirty animal from Moirang', a village in the south of the valley) is common.

**The Wild Dog** (*Cuon dukhunensis*)—Manipuri, *huithou*.

Not uncommon, in the hills and in the swamps in the south of the valley.

**The Jackal** (*Canis indicus*)—Manipuri, *lamhui* ('the wild dog').

Jackals are rare and do not multiply. They are said to have come up with the bullock carts, when the road through the hills to the Manipur valley from Assam was opened in 1896. Another tradition has it that a Political Agent who was administering the State during the minority of His Highness the Maharaja introduced missionaries, jackals and pleaders, in the interests of humanity. The Durbar have eliminated pleaders, but jackals and missionaries persist.

**The Himalayan Black Bear** (*Selenarctos thibetanus*)—Manipuri, *sāwom*.

This bear is common in the hills: between 1910 and 1924 the hillmen claimed rewards for 2,480 bears, at least 99 per cent of which must have belonged to this species. I only know one instance of a bear being found in the Manipur valley. In September, 1912, when I was staying at Moirang, at the southern extremity of the Loktak lake, some Manipuri fishermen brought in a large bear which they had killed with their paddles, as it was swimming across the lake. It had been visiting Ithing, an island on which His Highness the Maharaja has a fruit garden, and was making its way back to the western shore, about two miles from the hills.

**The Bruan or Malay Bear** (*Helarctos malayanus*)—Manipuri, *sāwom*.

This species occurs in the hills, but is rare. In a note recently published in the Journal,[1] I estimated the percentage brought in for rewards as not more than 1 per cent of the bears.

**The Sloth Bear** (*Melursus ursinus*).

Though common in Assam, this species does not occur at all in Manipur.

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The head 'Various and Big Game' in the records includes the waders noted on above, occasionally shot for the pot or purposes of identification, the game and other animals mentioned, and otters (Man., *sanamba*). The latter are common in the bils and rivers, and the Manipuris say that there are two varieties.

Hares do not occur in Manipur at all.

A few Gharial (*Gavialis gangeticus*) penetrate up the Barak river from Cachar, as high as Tipaimukh or a little higher. There are none elsewhere in the State.

(*The end*).

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[1] *J.B.N.H.S.*, vol. xxxv, No. 3, p. 673.

# SOME BEAUTIFUL INDIAN TREES.

BY

THE LATE E. BLATTER, S.J., PH.D., F.L.S. and W. S. MILLARD, F.Z.S.

## PART XV.

(*With one coloured plate*).

(*Continued from page 37 of this volume*).

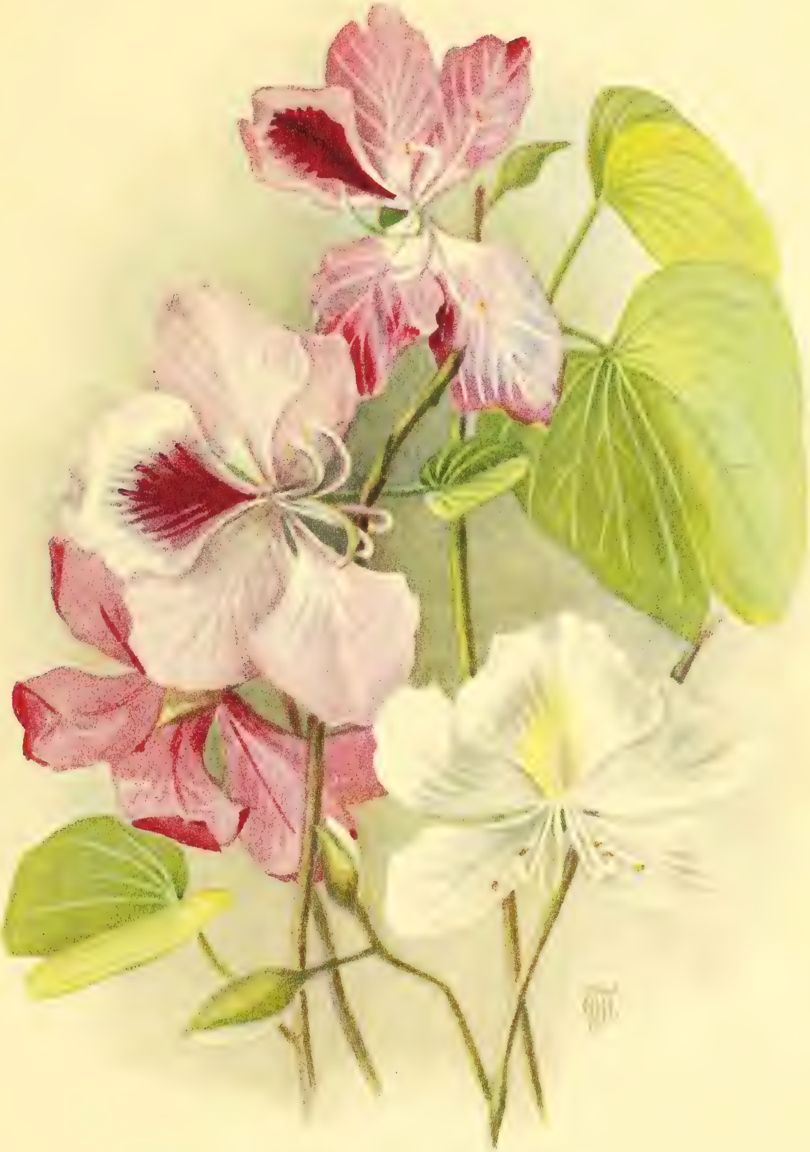
### THE VARIEGATED BAUHINIA.

*Popular names*: Kachnar (Hind.); Kanchan (Mar.); Bodantham, Mandari (Tel.).

**Bauhinia variegata** Linn. Sp. Pl. (1753) 375.—*Bauhinia candida* Roxb. Fl. Brit. Ind. ii (1832) 318.—The name *Bauhinia* was given in honour of John and Caspar Bauhin, sixteenth century herbalists, the twin leaflets suggesting two brothers.—Belongs to the family *Caesalpiniaceae*.

*Description*: A medium-sized tree with dark brown nearly smooth bark. The young shoots are covered with a brown pubescence. The leaves, which are shed during the cold weather, are 4-6 inches long, as broad or broader than long, with a median cleft reaching from ¼-⅓ the way down into the blunted lobes. When young they are minutely hairy but with age this character is lost except along the nerves and their axils, their texture is slightly leathery, the base is usually deeply heart-shaped, there are 11-15 nerves; the stalks vary from 1-1½ inches long. The flowers are large, fragrant, white or purplish, appearing when the tree is leafless, they are disposed in short, few-flowered, grey pubescent racemes at the ends of the branches or in the axils of the leaves, the flower stalks are short or absent with bracts and minute bracteoles which are slightly hairy and deltoid in shape. Calyx tube slender ½-1 inch long, the limb spathe-like, as long as the tube and 5-toothed at the apex, softly grey-haired. Petals 2-2½ inches long, obovate, with long rather broad claws, all white or 4 petals pale purple and the fifth darker with purple veins. Stamens 5 fertile, no staminodes. Ovary softly hairy along the sutures, long stalked; style long; stigma head-like. Pod 6-12 by ¾-1 inch, hard, flat, dehiscent or a hairless stipe 1 inch long. Seeds 10-15.

This beautiful tree has flowers of varied colours, pink white and mauve splashed with purple. The white flowering form (*candida*) is also common and is very striking with a yellow splash at the base of one or more petals. These trees flower from December to March or April. Mr. C. M. Tambe, Superintendent of



John Bale, Sons & Danielsson, L^td London

VARIEGATED BAUHINIA.
Bauhinia variegata Linn.
(about ½ nat. size.)

H. H. The Maharaja Holkar's garden at Indore, The Manik Bagh, says: 'this tree is planted largely there in gardens and avenues for ornamental purpose.'

*Distribution*: Found wild in the sub-Himalayan tract from the Indus eastwards, Assam, Burma, Chota Nagpur, C. Provinces, W. Peninsula. Cultivated largely.—Wild also in China.

*Gardening*: Often cultivated in gardens and will sometimes flower in its second year as a shrub. It thrives in a variety of soils. They delight in high well-drained land. It is very tender and easily affected by low temperatures. No particular care in tillage or fertilizing is necessary, but better bloom is secured if some attention is given to these details. Cuttings root with difficulty.

*Flowering, Leaf-shedding and Fruiting*: The leaves commence falling in November to December, and the tree is leafless or nearly so by March; the new leaves appear in April and May. The large pink to purple or white flowers appear from February to April, chiefly on the upper leafless branches, the lower branches often being still in leaf. The flowers are fragrant and are visited by bees, by whose agency pollination is effected. The pods form rapidly, ripening in May and June (Northern India); they are 6-12 inches by $\frac{7}{10}$–1 inch, hard and flat, with 10-15 seeds, and dehisce for the most part on the tree, scattering the seeds. The seeds are $\frac{1}{2}$-$\frac{3}{4}$ inch by $\frac{1}{2}$–$\frac{7}{10}$ inch, nearly circular, flat, brown, with a somewhat coriaceous testa, 70-100 weighing 1 oz.; they germinate readily and show a high percentage of fertility, which is retained to some extent for at least a year. (Troup).

*Natural reproduction*: The seeds, which are scattered before the beginning of the monsoon, germinate readily when the rains begin, and germinating seeds may be found in quantity round the trees. But unless the seed happens to become buried in earth and debris, or is sheltered from the sun, most if not all of the young plants may die off owing to the drying up of the radicle if exposed to the sun, while birds and insects also cause a good deal of mortality by eating off the radicles. The most favourable condition for the establishment of reproduction appears to be the presence of loose porous well-drained soil, in which in the first place the seed has a chance of becoming covered with earth, and in the second place the seedling develops sufficiently rapidly to overcome weed-growth. (Troup).

*Artificial reproduction*: The most successful means of raising the tree artificially is by sowing in lines in which the soil has been well loosened, followed by regular weeding and loosening of the soil. Unless regular watering can be carried out, transplanting is difficult except in the case of small plants during the first rains. The seed should be sown in May in drills 9-10 inches apart; the young plants usually appear in 4-10 days, and may be transplanted while still comparatively small during the first rains. Trees planted for ornament may be kept a second year in the nursery, but regular watering is necessary in the dry season following transplanting; in this case either the seedlings should be pricked out in the nursery during the first rains or the drills should be at least

12 inches apart, and the seedlings should be thinned out where necessary. (Troup).

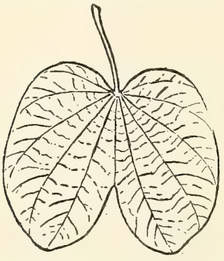
*Uses*: The flowers and flower-buds are eaten as a vegetable. The wood is used for agricultural implements and for fuel. The bark yields a fibre and is both eaten and used medicinally. The bark is astringent, tonic and alterative, and a decoction is useful in diarrhoea. The flowers are laxative. The dried buds are also useful in diarrhoea and worms, and a decoction of the root is an anti-fat remedy. The bark is also used in tanning and dyeing.

This tree can easily be mistaken for another beautiful tree often grown in Indian gardens.

### THE PURPLE BAUHINIA.

*Popular names*: Khairwal, karar, koliar, kaniar (Hind.); Atmatti (Mar.); Sarul, baswanapada, kanchivala (Kan.); Kanchan (Tel.); Mahahlegani (Burm.).

**Bauhinia purpurea** Linn. Sp. Pl. (1753) 375.



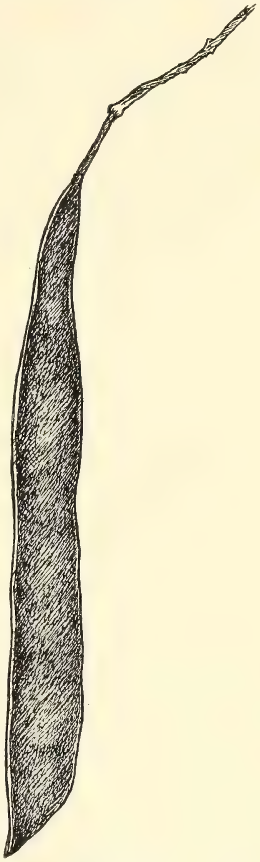
*Description*: A medium-sized tree with nearly ashy to dark-brown bark, leafless during the cold season, young parts clothed with brown pubescence. Leaves 3-6 inches long, rather longer than broad cleft about half way down into 2 pointed or rounded lobes, very minutely hairy beneath when young, base usually heart-shaped, 9-11 nerved; leaf-stalks 1-1$\frac{1}{2}$ inches long. Flowers large, rose, purple, disposed in few-flowered panicles at the ends of the branches, the panicles are covered with a brown tomentum, stalks $\frac{1}{3}$-$\frac{1}{2}$ inch long, stout and covered with a powdery substance; bracts and bracteoles small, tomentose, deltoid. Calyx tomentose, tube $\frac{3}{10}$–$\frac{2}{5}$ inch long, the limb twice as long as the tube usually splitting into 2 reflexed segments, one irregular margined, the other 3-toothed. Petals 1$\frac{1}{2}$-2 inches long, oblanceolate, long-clawed, spreading veined. Stamens usually 3 fertile, the others reduced to antherless filaments. Ovary downy, long-stalked, style long, stigma large and oblique. Pod 6-10 by $\frac{3}{5}$–$\frac{4}{5}$ inch, on a tomentose style, $\frac{3}{5}$–1 inch long, linear, flat, pointed, greenish tinged with purple till ripe, breaking up late. Seeds 12-15, almost round, flattened, $\frac{1}{2}$ inch in diameter, dark brown, smooth.

It grows sparingly throughout India and China and is cultivated in most parts of India.

*Flowering and fruiting*: The terminal panicled racemes of large purple, deep rose to lilac flowers appear amongst the foliage from September to December. The flowers are very fragrant, and are visited by numerous bees, by whose agency pollination is effected. The pods form rapidly, some attaining a fair length while the tree is still in flower; they ripen from January to March, and are then greenish purple, 6-12 inches by $\frac{7}{10}$–1 inch, flat, fairly thick, pointed, slightly falcate, with coriaceous valves, containing 10-15 seeds. The seeds are brown, compressed, $\frac{3}{5}$ by $\frac{1}{2}$ inch. They germinate readily and have a high percentage of fertility, which they retain unimpaired for at least one year; tests at Dehra Dun with seed kept for 14 months showed a fertility of 100 per cent. The pods dehisce on the tree during the hot season, scattering the seeds. (Troup).

*Natural reproduction*: The seeds germinate readily at the beginning of the rains, when numerous young seedlings may be found in the neighbourhood of seed-bearers. Where germination takes place on the surface of the ground, however, much mortality takes place owing to the drying up of the radicle if exposed to the sun. The survival of the seedlings is greatly facilitated if the seed becomes buried in loose earth before germination and the roots of the young plant are not exposed. (Troup).

*Artificial reproduction*: Experiments at Dehra Dun have shown that the best results are attained by line sowings kept regularly weeded; irrigation also has a marked effect on the growth. The seedlings are somewhat sensitive to transplanting, which has to be done with care. The seed should be sown in the nursery in April or May in drills 9-10 inches apart, and covered to a depth of about a quarter of an inch, regular watering and weeding being carried out. The seedlings appear in about 4-10 days, and can be transplanted while still of small size during the first rains. Transplanting with unpruned stem and roots should not be attempted during the second rains unless regular watering is possible for some time. A certain amount of success has been attained by transplanting after pruning the stem and taproot down to 2 and 9 inches respectively, but this checks the growth severely for a time. (Troup).



(*To be continued*).

# THE PALM CIVETS OR 'TODDY CATS' OF THE GENERA *PARADOXURUS* AND *PAGUMA* INHABITING BRITISH INDIA.

BY

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*Unofficial Assistant of the British Museum (Natural History).*

## Part III.

(*With 3 text-figures*).

(*Continued from page 192 of this volume*).

### Paradoxurus hermaphroditus ravus, Miller.

*Paradoxurus ravus,* Miller, *Smiths. Misc. Coll.*, lxi, p. 21, 1913.

*Paradoxurus hermaphroditus laotum*, Gyldenstolpe, *K. Sv. Vet. Akad. Handl.*, lvii, No. 2, p. 26, pl. iv, figs. 2-4, 1917 (February); and *Journ. Nat. Hist. Soc. Siam*, iii, p. 147, 1919; Robinson and Kloss, *Rec. Ind. Mus.*, xix, p. 179, 1920.

*Paradoxurus birmanicus*, Wroughton, *Journ. Bomb. Nat. Hist. Soc.*, xxiv, p. 51, 1917 (March).

*Locality of type of ravus*: Trang in Peninsular Siam (Lat. 8°N.).

*Locality of type* of *laotum*: Chieng Mai in N. Siam (said to be Laos).

*Locality of type* of *birmanicus*: Mingun, W. of Sagaing, Upper Burma.

*Distribution*: From Indo-China, N. Siam and Upper Burma southwards through Tenasserim to the northern Malay Peninsula.

*Note on the synonymy*: Miller briefly described a subadult ♂ and an adult ♀ (type) of *ravus* from Trang as distinguishable from the southern Malayan and Sumatran race, *musanga*, which he called *P. hermaphroditus hermaphroditus*, by having the ground colour of the upper parts noticeably paler (about pale-ecru drab) instead of brownish ochraceous tawny, so that the black spots and hair tips are thrown into greater contrast. This description and the flesh measurements of the type, as well as the measurements he gave of the two skulls, agree so closely with some examples Shortridge collected in Tenasserim Town that I do not doubt Wroughton correctly identified the latter as *ravus*. But these Tenasserim specimens are indistinguishable from a large series of specimens in the British Museum ranging from Pegu northwards to Sagaing in Upper Burma, whence the type of *birmanicus* came, the character upon which Wroughton relied for the separation of *birmanicus* from *ravus*, namely the blackness of the crown between the ears, being of no systematic importance since it varies profoundly in the same locality as shown below, more particularly in the series of skins from Toungoo. But Byldenstolpe claims that *birmanicus* is unmistakably synonymous with the race from N. Siam, or Laos, which he called *laotum;* and this name has a month's priority over *birmanicus*. Glydenstolpe's verdict on this point has been generally accepted and there are reasons for believing it to be correct, although his type is a little larger in skull and body than any of the Burmese specimens I have seen.

*Description*: Resembling *pallasii* in having the pattern of dorsal stripes and lateral spots distinct throughout the year, but in the winter coat the wool is shorter and altogether less luxuriant, and the long hairs are a little longer so that the coat is more shaggy; the ground colour, also, in a great majority of cases is grey sometimes clear, generally slightly or moderately buffy, very rarely exhibiting the richer ochreous buff hue which is common in *pallasii*, hence the pattern stands out more boldly in contrast with the paler interspaces; the brow-band is noticeably more conspicuous than in the Indian races and not subdivided by black speckling except occasionally in the middle line (Fig. 1, C, vol. xxxvi, p. 870). In the adult skull the postorbital processes are on the average smaller, and the external pterygoid crest larger; the teeth also are larger, $pm^4$ and $m^1$ having their inner portions better developed in a great majority of skulls; and in the female at least the sagittal crest, as a rule, is formed earlier while the milk dentition is still in use.

The distribution of this race from north to south in British Burma corresponds very closely in latitude with that of typical *hermaphroditus* in Peninsular India. Not surprisingly the two are tolerably similar as regards the growth of the underwool and the comparative shagginess of the coat owing to the relatively long overlying hairs. But these hairs are not so long in *ravus* and have far less extensive black tips, so that the pattern is not concealed, when the coat is fully developed, as it frequently is to a less or greater extent in the Indian race. Only very exceptionally too is that of *ravus* which, when unaffected by the moult, is a marked the brow-band of *hermaphroditus* matched in conspicuousness by facial feature.

In addition to a few unmeasured and mostly undated specimens from one or two localities in Burma, the Museum contains good series of examples collected for the Mammal Survey in Upper and Lower Burma and Tenasserim.

Mingun, W. of Sagaing in Upper Burma. Three adult or subadult moulting suckling females, including the type of *birmanicus*, and three immature skins (*G. C. Shortridge*), July 9-13. The general colour varies from tolerably uniform ashy grey to buffy grey and the pattern is distinct in all; the brow-band may be uniformly pale grey or mesially infuscate and in one example (No. 3316) it is completely divided by a black line 9 mm. wide but expanding above to 25 mm., where it passes into the black crown. The type (No. 3261) also has the crown black, the back clear ashy grey, without buff tinge, and the interspaces well defined owing to the scantiness of the black speckling; the forequarters are darker grey owing to more extensive black pigmentation.

In another (No. 3252) the crown is black except for a conspicuous median white line; but in No. 3336 the median third of the crown is speckled with grey, forming a band connecting the brow-band with the nape. The phenomena of coat change exhibited by these skins are described above (p. 315).

The three immature skins, with the head and body measuring about 14 in., resemble the older ones but show no signs of moulting either the long coarse hairs or the under fur. Three kittens, with the head and body about 10 in., were also collected; the coat is soft and furry with the pattern distinct, and the general colour varying, one being dull buffish grey, another less buffy and blacker, the third blacker still.

Another example from the same locality, a ♀ (No. 10.9.15.4) nearly full size but still with milk dentition, was collected by Major Harrington on January 11th. The winter coat is about as long as in the September examples but has abundant underwool. The ground colour is mostly clear, whitish grey, with at most a faint buff tinge, but the copious black tipped hairs rather obscure the pattern, the dorsal surface presenting a somewhat marbled black and white pattern. The black of the crown is mesially speckled.

Lower Chindwin. Several specimens collected by G. W. Dawson and given to Shortridge. Three flat native skins from Thayagon in the Budalin district, dated, but unreliably, August 20th, resemble the Mingun skins in having the coat long and shaggy, with little underwool, the general tint varying from clear to buffy grey and the crown either black or mesially speckled. An adult suckling ♀, June 4, also has the coat long and thin with no perceptible underwool, the general colour ashy grey, hardly obscured by black speckling, but with a slight buff tinge especially on the hindquarters, the nape with a good deal of grey and the crown mesially speckled. A flat unmeasured ♂ skin from Yin in the Nani town-ship, November 5th, has the coat thickened with plenty of underwool and the ground colour a rich ochreous buff, much brighter than the majority of examples of *ravus* and resembling the bright Assamese examples of *pallasii*, but at once distinguishable by the conspicuousness of the frontal band; the crown is mesially speckled.

Mt. Popa, 4,961 ft., some 70 miles S. of Lower Chindwin. Half a dozen examples, mostly young, collected by G. C. Shortridge between September 3 and 28. Closely resembling the Mingun and Lower Chindwin specimens dated June and July, but with plenty of underwool, the coat being nearly as full as in the January skin from Mingun, and with a rather more extensive range in colour, the extremes being an adult ♀ (September 28), in which the interspaces on the back are clear whitish grey, hardly dimmed by black speckling and emphasising the pattern, with the crown black and the nape more heavily pigmented, as in the type of *birmanicus;* and a young ♂ (September 3), which is considerably darker, almost brown by comparison owing to the interspaces being almost ochreous buff, but dimmed by the extreme black pigmentation of the hair-tips so that the distinctness of the pattern is obscured. The other skins are more or less intermediate between these two.

Toungoo. About a dozen adult and young adult specimens collected by J. M. D. Mackenzie, 6 miles E. of the town, 100 ft., and from 20 to 30 miles N. and N.-W. of it, 500 ft., between September 10 and 19, February 3 and 29, March 2 and 27. The colour and pattern on the average are the same as in the Mingun, Chindwin and Mt. Popa specimens, clear ashy to buff grey and the crown similarly varies, being either black or mesially speckled with grey in the same month of the year. The two extremes are a young adult ♂ (No. 1341), September 11, in which the coat is short, about 30 mm., the general colour dull olive grey, with the pattern well defined, the stripes coalescing on the shoulders and blackening them, the nape black in the middle, speckled black and greyish buff on the sides, the crown jet black; and a subadult ♂ (No. 1463), March 2, in which the coat is longer, about 40 mm., the general colour pale buffy grey, the hairs having whiter, more extensive pale areas, and less black at their tips, the pattern less well defined owing to the longer coat, the shoulders and nape grey, speckled with black and the crown thickly speckled with grey as far externally as the small black patch at the base of the ears. There is also an adult ♀ skin and skull from Toungoo (*Wardlaw Ramsay*, No. 79.11.20.1), with harsh, thinnish summer coat, with the moult imminent, and large isolated teats; the general colour is dull buff grey on the hind back and rump, darker, blacker grey forwards; the crown from between the ears is entirely black and the pattern of stripes and spots is well defined.

A young ♀ belonging to Mackenzie's lot, January 29, is of interest on account of its bright yellowish buff ground colour, like the skin from Yin in Lower Chindwin, both above and below.

A young ♂ from the northern Zamayi Reserve, 80 miles N. of Pegu town (*J. M. D. Mackenzie*), April 30, is interesting from the effects of the moult upon the coloration. The coat is short, thickish without long hairs, the general tint faded greyish buff, the pattern brownish and ill-defined, and the head from between the eyes, the neck and forequarters uniformly dull brownish grey, the white and black tipped hairs, which normally make a contrast between the grey frontal band and the darker crown being alike absent. When in fresh coat this specimen probably resembled the young brightly coloured example from Toungoo.

An adult ♀ from Kyeikpadam in Lower Pegu (*E. W. Dates*), August 25, has the coat harsh and long, about 46 mm., with scanty underwool, the general colour closely resembling that of the normal more northern specimens, dark ashy grey with a wash of a buff on the back and rump and the pattern well defined.

A skin, without date or other particulars, from Wimpong, Thatone, 52 miles N.-W. of Moulmein (*W. Davison*), has the coat thick and full, about 38 mm. long, the colour is brighter buff than in the specimen from Lower Pegu and unmistakably resembles that of the brightly tinted skin from Yin in Lower Chindwin. In patches the hairs are quite yellow from fatty secretion from the skin.

Tenasserim Town. An adult ♀, March 5, and two subadult ♂, March 14 (*G. C. Shortridge*). The ♀ (No. 4886) has the coat longish, with scanty underwool, the general colour ashy grey above and below, with a faint tinge of buff on the mid lumbar region (? due to dorsal gland), the neck darker grey than the back, the crown conspicuously grizzled mesially, the coloration very like that of many of the more northern Burmese specimens. One of the ♂ specimens (No. 4907) is darker than the ♀ owing to a decided buff wash on the back and flanks, and to the dorsal interspaces being more extensively speckled by the black tips of the hairs. This skin closely resembles the one from Lower Pegu but is a little buffier. The other ♂ (No. 4937) is, on the contrary, decidedly lighter than the ♀ and shorter coated, the general colour is not so ashy, rather creamy greyish white, the pale hue of the dorsal interspaces being more extensive and the black tips to the hairs less in evidence, so that the pattern is more emphatic; the nape is also much paler and the crown more extensively speckled both on its individual hairs and externally towards the ears. This skin almost exactly matches the pale skin from Toungoo (No. 4937).

The difference between these skins shows that the coloration of *ravus*, if I am right in assigning them to that race, is more variable than Miller's description of the specimens from Trang suggests. Similar variations, in my experience, are exhibited by all continental races of *Paradoxurus hermaphroditus*.

In the following table of flesh measurements the specimens are arranged geographically from north to south.

| | In English Inches. | | | | |
|---|---|---|---|---|---|
| Locality, Date and Sex. | Head and Body. | Tail. | Hind Foot. | Weight. | Coat in mm. |
| Mingun, W. of Sagaing (3316) July 13. ad. ♀ | 22⅘ | 19⅘ | 3⅗ + | 6¾ lbs. | 38 |
| Mingun, (*birmanicus*-type). July 9. ad. ♀ | 22⅘ | 20⅖ | 3⅗ | 7¼ ,, | 41 |
| Mingun (3252). July. ad. ♀ | 21⅖ | 20 | 3⅕ | 6½ ,, | ... |
| Mingun (Harrington). Jan. 11, immat. ♀ | 20⅘ | 20⅖ | 3⅕ | ... | 44 |
| Kin, Lower Chindwin (5387). June 14. yg. ad. ♀ | 24⅖ | 21 | 3⅖ | 7½ lbs. | 46 |
| Thayagon, Lower Chindwin (3905), Aug. 20. ad. ♀ | 20 | 19½ | 3 + | ... | 46 |
| Mt. Popa (3901). Sept. 28. yg. ad. ♀ | 22½ | 19⅕ | 3⅕ | 6¾ lbs. | 46 |
| ,, (3883). Sept. 25. yg. ♂ | 20⅕ | 19 | 3⅖ | 5¾ ,, | 40 |
| Toungoo (1508). Feb. 23. ♂ | 23½ | 18⅕ | 3⅗ | ... | 41 |
| ,, (1341). Sept. 11. ♂ | 22⅘ | 23 | 3⅖ + | ... | 30 |
| ,, (1340). Sept. 19. ♂ | 22 + | 21⅘ | 3⅖ | ... | 34 |
| ,, (1474). March 27. ♀ | 22⅕ | 19 – | 3⅖ | ... | 45 |
| ,, (1509). Feb. 23. ♀ | 23⅘ | 23 | 3⅖ | ... | 40 |
| Tenasserim Town. March 14. yg. ad. ♂ | 24 + | 20 | 3⅗ | 8 lbs. | 36 |
| Tenasserim Town, March 14. yg. ad. ♂ | 23⅗ | 18⅘ | 3⅗ | 7 lbs. | 33 |
| Tenasserim Town ; March 5; yg. ad. ♀ | 22 | 19⅕ | 3⅖ | ... | 41 |
| Trang, Penin. Siam. (*ravus* type) ad. ♀ | 23⅕ | 18⅘ | 3⅗ | ... | ... |

The following conclusions may be deduced from this table:— In general size *ravus* agrees with *pallasii;* the males and females are approximately similar in bodily size; individual variation in size at least in the females is considerable as attested by the two from Lower Chindwin, the young adult ♀ from Kin being nearly 6 in. longer from nose to tail-tip than the adult ♀ from Thayagon; Miller's type of *ravus*, despite its comparatively small skull, is only surpassed in dimensions by two of the Burmese skins. It is unfortunately impossible to estimate accurately the age of most of the Toungoo specimens because only one skull is available.

| Locality and Sex. | In English Inches. | | | | | In Millimetres. | | |
|---|---|---|---|---|---|---|---|---|
| | Total length | Zygom. width. | Waist width. | Int. orb. width | Max. width. | Bulla. | Pm⁴ | M¹ |
| Allagappa, W. of Sagaing ; ad. ♂ | 4·5 | 2·7 | ·5½ | ·8½ | ·9 | 17 | 9 × 7 | 6½ × 8½ |
| Legyi village, W. of Sagaing ; ad ♂ | (4·4½) | 2·7½ | ·5 | ·8 | ·8½ | ... | 9 × 7 | 7 × 8 |
| Mingun, W. of Sagaing ; ad. ♂ | 4·3 | 2·4 | ·4½ | ·8— | ·8 | 17 | 9 × 7 | 6 × 8 |
| Toungoo (1463) yg. ad. ♂ | 4·3 | 2·5 | 5½ | ·8 | ·8 | 18½ | 9 × 6½ | 6½ × 9 |
| Kyeikpadam, Lower Pegu ; ? ad. ♂ | (4·2) | 2·4½ | ·5– | ·7 | ·8 | ... | 9 × 7 | 6 × 9 |
| Tenasserim Town ; yg. ad. ♂ | 4·6 | 2 5 | ·4½ | ·7 | ·8⅓ | 17 | 9 × 7 | 6 × 8 |
| ,, ,, yg. ad. ♂ | 4·4 | 2·4 | ·4½ | ·7½ | ·8 + | 17½ | 9 × 7 | 6½ × 8 – |
| Mingun (*birmanicus*-type) ad. ♀ | 4·4 | 2·3½ | ·5 + | ·7½ | ·8 + | 18 | 8½ × 7 | 6 × 8 |
| ,, (3316) ad. ♀ | 4·3½ | 2·4 | ·4 | ·8 | ·8 | 17 | 9 × 7½ | 6½ × 7½ |
| ,, (3252) yg. ad. ♀ | 4·1 | 2·2 | ·5 | ·7 | ·7 + | 17 | 9 × 7 | 6½ × 8 |
| ,, (Harrington) ; immat. ♀ | 4·0 | 2 | ·4½ | ·6 | ·7 – | 19 | ... | ... |
| Thayagon, Lower Chindwin (3905) ad. ♀ | 4·3 | 2·4 – | ·4½ | ·7½ | ·8 | 17 | 9 × 7 | 7 × 8½ |
| ,, (3904) yg. ad. ♀ | 4·1 | 2·2 | ·5 | ·7 | ·7 | 18 | 8½ × 7½ | 6 × 7½ |
| Kin (3903) ad. ♀ | 4·4 | 2·3 – | ·5 | ·7½ | ·7½ | 18 | 8½ × 6½ | 6½ × 8 |
| Lower Chindwin (5387) yg. ad. ♀ | 4·4 | 2·2 | ·4 – | ·6 | ·8 – | 16½ | 9 × 7 | 7 × 9 |
| Mt. Popa (3901) yg. ad. ♀ | 4·1½ | ... | ·4½ | ·6¾ | ·7 | 18 | 9 × 7 | 7 – × 8 |
| Toungoo (Ramsay) ad. ♀ | (4·4) | ... | ·5 | ·7 | ·7½ | ... | 9 – × 7 | 6½ × 8 |
| Tenasserim Town ; yg. ad. ♀ | 4·4 | 2·4 + | ·4½ | ·7 + | ·8 – | 17 | 9 × 7 | 6½ × 8 – |
| Tenasserim Town ; yg. ♀ | 4·1½ | 2·1 – | ·5 | ·6 | ·7 | 17½ | ... | 6 × 8 |

In general dimensions the skulls of *ravus* agree closely with those of *pallasii*, ♂ skulls being slightly larger than ♀. The teeth are on the average a little larger in *ravus*, especially in width, and are more variable in shape. Very commonly the inner surface of the upper carnassial (*Pm*$^4$) is provided with a distinct ledge (cingulum) passing obliquely from its anterior inner lobe to its posterior cusp, so that the tooth is more triangular in shape, with its inner surface not so deeply emarginate nor noticeably concave as in *pallasii* and other Indian races. But this ledge differs greatly individually in development. In the larger of the two ♂ skulls from Tenasserim Town, for instance, it is prominent; in the smaller it is absent, the tooth resembling in shape that of *pallasii*. The bullae also vary individually in length and shape. They are much larger, for example, in the immature ♀ skull from Mingun (Harrington) than in the young adult female from Kin in Lower Chindwin, these being the two extremes, with other skulls from Mingun intermediate. The inflation may also be very noticeably compressed or evenly convex. This difference is shown even in the small series from Tenasserin Town.

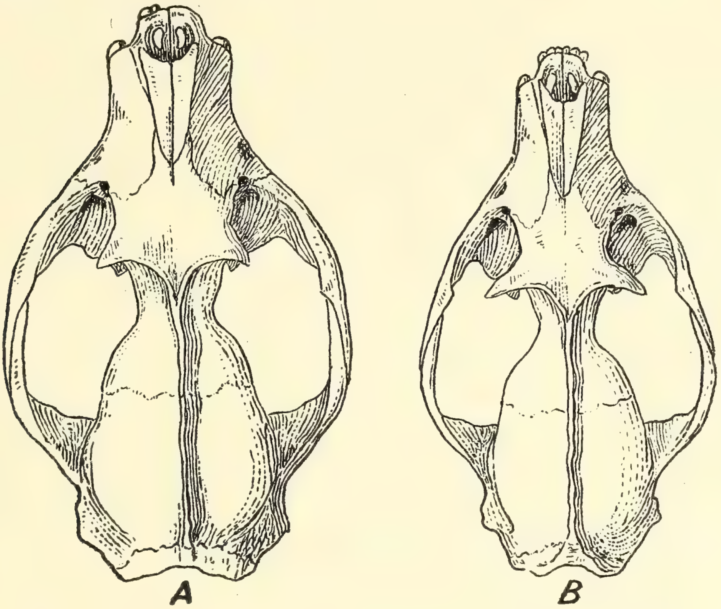

Fig. 5.—*A*. Skull of adult male of the Burmese race (*P. h. ravus*) from 30 miles west of Sagaing. *B*. Skull of adult male of the Lesser Palm Civet (*P. h. minor*) from Bankachon, Tenasserim. Figs. 2/3 nat. size.

Since my identification of this Burmese series as *ravus* rests mainly on my belief that the specimens from Tenasserim Town are, as Wroughton thought, racially inseparable from Miller's specimens from Trang in Peninsular Siam, I may add that the smaller of the two young adult males from Tenasserim Town agrees very closely in its measurements with those recorded by

Miller for his young adult ♂ from Trang. The condylobasal length of 109 mm. is 1 mm. longer, the zygomatic width 60½ mm. is about 2 mm. greater, the cranial width 35 mm. is the same, the int-orbital width 19 mm. is less than 1 mm. wider, the maxillary width 21 mm. is 1 mm. wider and the upper cheek teeth, excluding the incisors 41 mm. is 1 mm. less. The difference between the ♀ skulls from the two localities is greater. In the ♀ from Tenasserim Town the condylobasal length, 110 mm., is 5½ mm. greater; the cranial width, 35 mm., is 2 mm. wider; the zygomatic width, 62 mm., is nearly 4 mm. wider; the int-orbital width, 18 mm., is the same; the maxillary width, 20 mm., is barely 1½ mm. wider, the upper cheek teeth, 41 mm., are about 3 mm. longer. But in my opinion these differences fall within the range of individual variation judging from the variation exhibited by the ♀ skulls from Mingun and Lower Chindwin.

As regards the age at which the sagittal crest is developed, a point referred to under *pallasii*, it may be noted that in the immature ♀ skull from Mingun (Harrington), which still carries all its milk teeth and has a condylobasal length of 102 mm., the temporal ridges are just in contact. The same is true of a young male with milk teeth, from Toungoo and in a young specimen from Tenasserim, in which the tooth change has started. In the youngish ♀ from Kin, Lower Chindwin (No. 5387), with all the second teeth in use except the upper $pm^3$ and lower $pm^4$, of which the points only are showing, the crest is as well developed as in the adult type-skull of *birmanicus* from Mingun. That this comparatively early development of the sagittal crest is not, however, invariable in the race, is shown by the skull of the young ♂ from the Zamayi Reserve in Pegu. The milk teeth are all in place with $m^1$ through the bone, yet the temporal ridges are widely separated, 13 mm. apart on the parietals.

### PARADOXURUS HERMAPHRODITUS MINOR, Bonh.

*Paradoxurus minor* Bonhote, *Fasc. Malay. Zool.*, i, p. 8, 1903.

*Locality of type*: Kampong Jalor in Peninsular Siam.
*Distribution*: Malaya, Peninsular Siam, Tenasserim, ? Annam.

Distinguished from *ravus* by its smaller size, less robust dentition and by the inconspicuousness of the frontal band which, although variable in its amount of grey speckling, is not so sharply contrasted with the crown and there is no pale patch on the muzzle; the general colour also is typically much brighter although not brighter than in a few exceptional examples of *ravus*, but these may be distinguished from *minor* by their larger teeth and conspicuous brow-band and white patch on each side of the muzzle.

Two examples, collected in Tenasserim by G. C. Shortridge for the Mammal Survey, were originally identified by Wroughton as *Paradoxurus hermaphroditus* and subsequently as *P. ravus*. On neither occasion did Wroughton distinguish them from the examples collected at Tenasserim Town, also by Shortridge, despite the marked difference between them.

Bankachon, Victoria Point. Ad. ♂. December 17. Coat full and moderately long, about 35 mm.; ground colour of back and flanks rich ochreous buff fading in brightness on the fore quarters and everywhere overlain by the long black tips of the hairs which also render the pattern rather obscure; belly greyish brown with an ochreous wash; head brown with the frontal band merely represented obscurely by fine grey speckling; the blackness of the muzzle and cheek relieved only by the grey subocular spot; the throat, feet and distal three fourths of the tail black.

Thaget on the Little Tenasserim River. A young adult ♂; March 25. Closely resembling the last in general colour, but the nape of the neck not so dark and the frontal band better developed, consisting of a large patch of grey-speckled hairs on each side of the black middle line of the forehead, and the belly greyish brown without such noticeable ochreous wash.

Both in flesh-dimensions and cranial measurements these two specimens are a little larger than the type and examples from the Malay Peninsula I have seen; but the material is insufficient to justify the attachment of systematic importance to the differences.

The flesh measurements in English inches and weights of the two Tenasserim specimens and the measurements of the type are as follows:—

| Locality and Sex | Head and Body | Tail | Hind Foot | Weight | Coat |
|---|---|---|---|---|---|
| Bankachon, Victoria Point; Dec. 17; yg. ad. ♂ | 19⅘ | 19 | 3+ | 4½ lbs. | 35 mm. |
| Thaget, Little Tenass. River; March 25; yg. ad. ♂ | 19⅗ | 19 | 3 | 5¼ ,, | 32 ,, |
| Jalor, Peninsular Siam (type); Nov. 3; yg. ad. ♀ | 18 | 18½ | 2⅗ | ... | 26 , |

The following are the skull measurements of the same.

| | In English Inches | | | | | In Millimetres | | |
|---|---|---|---|---|---|---|---|---|
| Locality and Sex | Total length | Zygom. width | Waist width | Int. orb. width | Max. width | Bulla | $Pm^4$ | $M^1$ |
| Bankachon; yg. ad ♂ | 4·1 | 2·2 | ·4 | ·6½ | ·6¾ | 16 | 7½ × 5 | 6 × 7 |
| Thaget; yg. ad. ♂ | 4·0 | 2·1 | ·5 – | ·7 | ·7 | 16 | 8 × 6 | 6 × 7 |
| Jalor (type); yg. ad. ♀ | 3·7 | 2 + | ·4¾ | ·6½ | ·6 | 15 | 8 × 6 | 5½ × 7 |

The skull from Bankachon, with a condylobasal length of 98 mm., although still showing the occipital suture, is muscularly well developed, with narrow waist, complete sagittal crest, 4 mm. high on the frontals, and large postorbital processes measuring 31 mm. from point to point. In the two ♂ skulls of *ravus*, of about the same age, from Tenasserim Town, the processes are not only thinner and more pointed but measure 30 and 28 mm. across respectively, although the skulls are considerably larger. The skull from Thaget is a little younger and less well developed.

The typical ♀ skull, with a condylobasal length of 95 mm., is about the same age as the ♂ skulls but has no sagittal crest, the temporal ridges being separated throughout and 10 mm. apart on the parietals and the postorbital processes are 23 mm. from tip to tip. In this tardy advance of the temporal ridges this ♀ skull differs from ♀ skulls of *ravus* from Burma and resembles ♀ skulls of *pallasii* from Assam.

The dentition too of *minor*, $pm^4$ and $m^1$ lacking the development of the inner portion characteristic of *ravus*, is more like the dentition of *pallasii* and other Indian races.

From various islands of the Mergui Archipelago the following six subspecies were described by Miller (*Smiths. Misc. Coll.*, 61, pp. 3-5, 1913). I have seen no specimens from these islands and can only judge of these races, three of which were described from single specimens, from the analogy supplied by mainland races.

*P. h. senex.* Domel Isl. A single young adult ♂ distinguished from Miller's examples of *ravus* from Trang in Peninsular Siam by having less traces of yellow on the back and sides and greatly reduced auditory bullae which are slightly inflated and only 10½ mm. from the paroccipital process, not including it, as in my measurements. Miller himself was dubious as to the constancy of the colour difference; and in view of the variations between the three specimens of *ravus* from Tenasserim Town, no reliance can, in my opinion, be placed upon it. The bulla is small; but it is not clear where the measurement was taken: the bulla, of the bigger ♂ skull of *ravus* from Tenasserim Town is 10½ mm., measured from the process along its lower surface. In the other specimens it is 13 mm. Clearly more specimens are required from Domel Island to establish the validity of *senex.*

*P. h. fuscus.* James Island. A single adult ♀ described as differing from *senex* by its more extensive black markings and sooty brown underside. Both these colour-features are too variable individually in mainland forms to be trusted on the evidence of a single specimen.

*P. h. pallens.* Kisseraing Isl. A single adult ♂ differing from Miller's specimens of *ravus* by having the tail distinctly brownish instead of essentially black, its basal third being the same colour as the head and body and contrasted with its distal portion. In the examples I assign to *ravus* the tail is typically black, but in a few specimens it is deep brown in its terminal portion. Moreover in a large number of specimens the basal third of the tail above and below is like the back.

*P. h. pugnax.* Sullivan Island. Two specimens like *pallens* but slightly smaller and with the dark markings rather more extensive especially on the thighs, upper part of fore legs, nape and cheeks. Similar differences fall within the range of individual variation in the series I assign to *ravus.*

*P. h. sacer.* St. Matthew and St. Luke Islands. Five specimens like the Kisseraing specimen but with the stripes reduced and broken up into lines of spots and the skull smaller, the smallest from the Mergui Archipelago and scarcely exceeding that of *P. minor.* In none of the mainland specimens of *ravus* is the dorsal pattern disintegrated into spots.

*P. h. pulcher.* Clara Island. Two specimens like *pallens* of Kisseraing Island, but ground colour both above and below between cartridge-buff and cream-buff, more yellowish than in any of the other known races. It does not appear that these specimens differ in colour from *pallens* more than the very brightly tinted young example of *ravus* from Toungoo differs from typical grey specimens from that locality.

The flesh measurements in English inches of the types of these described Mergui races are as follows:—

| Name, locality and sex | | Head and body | Tail |
|---|---|---|---|
| Domel Island (*senex*) | yg. ♂ | 21 | 18⅗ |
| James Island (*fuscus*) | ad. ♀ | 20 | ... |
| Kisseraing Island (*pallens*) | ad. ♀ | 21½ | 17 |
| Sullivan Island (*pugnax*) | ad. ♀ | 20⅘ | 17− |
| St. Matthews Island (*sacer*) | ad. ♀ | 20⅘ | 17− |
| Clara Island (*pulcher*) | ad. ♀ | 19⅕ | 18⅕ |

This table shows close agreement in size between specimens from different islands; but it supports the conclusion that collectively they are a little smaller than the mainland form *ravus*, although the difference between the adult ♀ (*pallens*) from Kisseraing Island and the adult ♀ (*ravus*) from Tenasserim Town is negligible.

In the following table are given some skull measurements recorded by Miller in mm. converted into English inches, for comparison with those used in my tables above.

| Locality and Sex | Cond. bas. length. | Zygom. width. | Int. orb. width. | Max. width. |
|---|---|---|---|---|
| Domel Island (*senex*) yg. ad. ♂ | 3·9 | 2·3+ | ·7 | ·8 |
| James Island (*fuscus*) ad. ♀ | 4·0 | 2·1 | ·6½+ | ·7 |
| Kisseraing Island (*pallens*) ad. ♀. | 4·1 | 2·3 | ·7¼ | ·8– |
| Sullivan Island (*pugnax*) ad. ♀ | 3·9+ | 2·2½ | ·7 | ·7½ |
| St. Matthews Island (*sacer*) ad. ♀ | 3·9+ | 2·2½ | ·7 | ·7½ |
| ,, ,, ,, ad. ♂ | 4·0 | 2·4– | ·7 | ·7½ |
| Clara Island (*pulcher*) ad. ♀ | 4·0 | 2·2½– | ·6¾ | ·7½ |
| ,, ,, ,, ad. ♂ | 4·1– | 2·4+ | ·6¾ | ·8 |

Collectively these skulls are smaller than those of *ravus*; but there is not much to choose between them and the skulls of the Tenasserim specimen of *minor*. So far as the measurements themselves are concerned, they fall within the limits of individual variation in mainland races.

## Genus: Paguma, Grey.

*Paguma*, Gray, *Proc. Zool. Soc.*, 1831, p. 94; and of all recent authors.

*Paradoxurus*, Blanford (in part).

*Type of genus*: *larvata* Gray, from S. China.

*Distribution*: from S. China westwards to Tibet and Kashmir, and southwards to Sumatra and Borneo.

The external differences between this genus and *Paradoxurus* are comparatively unimportant. *Paguma* never shows a trace of pattern of spots and stripes, there is a median pale band on the face extending from the rhinarium to the crown and, so far as my experience goes, there are always two pairs of mammæ, instead of three pairs which seem to be invariable in *Paradoxurus*. The essential differences between them in the skulls are given above and need not be repeated.

Setting aside the Tibetan species described by Hodgson as *Paradoxurus lanigerus*, of which the skull is unknown, most authors have assigned three species to *Paguma*, namely: *grayi* from the Himalayas, a medium-sized form with an obscurely defined 'mask' or facial pattern, a long luxuriant winter coat, and dark, buffy-grey in tint from the crown to the rump; *larvata* from China, a smaller form also with a long, thick winter coat, but more richly tinted on the body with the nape and part of the shoulders black and a very pronounced black and white 'mask'; and *leucomystax* from Malacca, Sumatra and Borneo, the largest of the three, with a shorter, thinner coat, darker brownish hue and obscurely defined mask. These were the earliest described species, and widely sundered geographically; but specimens subsequently collected in Burma, Indo-China, Siam and the northern part of the Malay Peninsula show intergradation in all the supposedly specific characters,—size, coat, colour and the pattern of the mask. Hence I have no hesitation in accepting the conclusion of Robinson and Kloss that the three original names indicate extreme racial forms of but one species, which must take the oldest name, *larvata*.

I admit two species of *Paguma* which may be distinguished as follows:—

| | | |
|---|---|---|
| *a*. | Tail short, only about half the length of the head and body ... ... ... ... | *lanigera*. |
| $a^1$. | Tail long, nearly, sometimes quite as long as the head and body ... ... ... | *larvata*. |

### PAGUMA LANIGERA, Hodgson.

*Paradoxurus lanigerus*, Hodgson, *Asiat. Res.*, xix, p. 79, 1836.

*Paradoxurus laniger*, Hodgson, *Journ. As. Soc. Bengal*, x, p. 909, 1841; *id. op. cit.*, xi, p. 279, 1842; also of Gray and Blanford as *Paradoxurus* or *Paguma*.

*Paguma grayi*, Wroughton, *Journ. Bomb. Nat. Hist. Soc.*, xx, p. 50, 1918 (not *grayi*, Bennett).

*Locality of type*: An only known specimen, originally said to be 'the northern region of Nepal', but in 1842 said to be Tingree in Tibet.

Although the skull of this species is unknown, I adopt without hesitation the view that it belongs to *Paguma* because of its distribution and the absence of all trace of pattern on the body combined with the forward growth of the hair on the nape. It differs from all the other species of *Paguma* and all the species of *Paradoxurus* in the shortness of the tail which is only about half the length of the head and body. This feature was ignored by Wroughton when he cited *lanigera* as a synonym of *grayi*.

The following is a description of the type and only known specimen preserved in the Natural History Museum (No. 43.1.12.103):—

Dorsal coat from the crown backwards very thick, woolly and matted, about 40 mm. long, the wool copiously mixed with fine, whitish hairs with their curled, frizzled ends hardly projecting beyond the summit of the wool; hairs of the face, paws, throat and belly sleek and comparatively short, general colour pale brown, darker and more rufous on the back than on the flanks; legs and upper side of tail like the back; ventral surface mostly creamy white from the throat backwards. No black tipped or annulated hairs and no trace of pattern; the superciliary vibrissae buffy grey; genal vibrissae white; mystacial vibrissae not preserved. Hair reversed in growth along the nape and on the crown between the ears. Tail woolly like the body, thick at the base whence it gradually tapers to the point, only about half as long as the head and body. Soles of the feet and pads apparently quite normal in their hairy clothing. Head and body about 20 inches, tail 9½ inches; the tail is apparently perfect but Hodgson gave its length as 12 inches.[1]

From the condition of the coat of this skin I have no doubt that the moult was imminent. The new coat, it is likely enough, would be very differently coloured, possibly provided with black or partially black hairs, which were already moulted or had lost their black tips at the time of death. The thickness of the basal part of the tail suggests an accumulation of fat for sustenance in the winter months during which the animal perhaps hibernated.

### PAGUMA LARVATA, Gray.

The principal bibliographical references to the British Indian representatives of this species are quoted below under the various subspecific headings. It may be distinguished from *lanigera*, the only other species of the genus, here admitted, by the length of the tail as stated above. Its distribution is from Southern China westward through the Himalayas to Kashmir and southwards to Sumatra and Borneo.

The following is a key to the British Indian races:—

*a*. Hairs of preaural fringe at most projecting forwards a comparatively short distance over the cheek to form with their tips a crest some distance behind the eye.
  *b*. Pattern of mask emphatically black and white, the median band separated from the pale areas between the eye and ear and continued over the nape to the withers or beyond ... ... ... *intrudens.*
  *b*¹. Pattern of mask less emphasised, the median band confluent on the forehead with the pale areas between the eye and ear and not continued as a definite stripe beyond the forepart of the nape.
    *c*. Size large, coat longer and thicker, pattern of mask more distinct, its pale areas lighter than the general tint of the back.
      *d*. Nape black, with the pale median area of the crown sharply contrasted with it, size larger. *wroughtoni.*
      *d*¹. Nape typically copiously speckled with grey like the back and not sharply contrasted with the crown of the head.
        *e*. Winter coat much longer and thicker ... *grayi.*
        *e*¹. Winter coat shorter and thinner ... *neglecta.*
    *c*¹. Size small coat shorter and thinner, pattern of mask obscure, its pale areas the same tint as that of the back ... ... *tytlerii.*

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[1] Hodgson may have had more than one specimen. In his unpublished drawings he gives three illustrations of the species and one of them is more richly coloured than the others.

$a^1$. Hairs of preaural fringe projecting so far forwards as to form a crest close to the eye, defining a large whitish area on the cheek.
  *f*. General colour tawny, nape at most pale brown ... ... ... *robusta.*
  $f^1$. Colour much darker, nape deep blackish brown ... ... ... *janetta.*

The primary distinctive features used in this table are those of the three forms, formerly regarded as distinct species, namely *larvata, grayi* and *leucomystax.* The characters cited in paragraph *b*, eliminating *intrudens*, are true of most but not all, examples of typical *larvata*, the southern Chinese race. Those cited in paragraph $b^1$ under which are comprised *wroughtoni, grayi, neglecta* and *tytlerii*, apply to *grayi* as understood by Blanford. Finally, those cited under $a^1$ comprising *robusta* and *janetta*, apply to most specimens formerly regarded as *leucomystax.*

### PAGUMA LARVATA WROUGHTONI, Schwarz.

*Paradoxurus grayi*, Blanford, *Mamm. Brit. Ind.*, p. 112, 1888 (in part).

*Paguma grayi wroughtoni*, Schwarz, *Ann. Mag. Nat. Hist.* (8), xii, p. 289, 1913; Wroughton, *Journ. Bomb. Nat. Hist. Soc.*, xx, p. 51, 1918.

*Locality of type*: Gharial near Murree in the Upper Punjab.
*Distribution*: Kashmir and the Upper Punjab.

Distinguished from the earlier described Himalayan race, *grayi*, and approaching the Chinese race *larvata*, chiefly by the generally black hue of the nape and fore portion of the shoulders, resulting from the partial or complete suppression of pale speckling in the hairs of those areas; by the more sharply contrasted facial pattern and by the extension of the pale hairs of the crown to form a short median, whitish streak set off by the blackness of the nape. The winter coat also appears to be longer, looser, with less luxuriant underwool than in *grayi*. The two races, however, completely intergrade.

The type of *wroughtoni* is the undated, unmeasured skin of an old ♂ from Gharial, near Murree in the Upper Punjab (Major H. N. Dunn, B.M. No. 7.11.21.11). The coat is long, about 46 mm. and loose with comparatively short and thin underwool. The general colour of the back is dark greyish due to an intimate mixture of black and pale speckling in the hairs of the upper side, the pale speckling buffy grey on the hind back, clearer on the fore back and reduced by the extension of the black to a nearly negligible amount on the nape and fore part of the shoulders. Tail gradually darkening in its distal half. The under side whitish. The 'mask' is strongly emphasized; the sides of the muzzle and area round the eyes brown; the middle line of the nose and forehead greyish white, the crown between the ears and the greater part of the cheek, owing to the large size and confluence of the patches above and below the eyes and the preaural fringe, grey; but behind the crown on the occiput the median pale band forms a conspicuous whitish streak set off by the black hairs on each side of it.

A young adult ♀ with the same history, but dated June 13, is very similar to the ♂ but has the coat a little longer, about 50 mm., and the cheeks browner owing to the isolation of the subocular spot.

A skin, without skull or further particulars but ticketed Sopir (Sopur, 65 miles N.E. of Murree, near Lake Wular), Kashmir, is of interest as being the most northern representative of the species yet recorded. It has the same loose, long coat, 52 mm., as the Gharial specimen and closely resembles the type.

At Chamba, H. W. Wells procured two examples for the Survey. A young ♂ from Deolah, 6,000 ft., January 5, has the coat long and loose, about 54 mm., as in the other specimens, although the underwool is considerably longer; the nape is black and the face, apart from the sides of the muzzle mostly grey. The other example from Pangi, 9,000 ft., is a flat skin with no measurements, dated December 23rd, but this is no doubt the date of the donation of the skin to Wells, not of its capture, because the coat is only 40 mm. and appears to be new. The face is dominantly grey, as in the one from Deolah, the nape is black with minute buff speckling and the back has abundance of black speckling. At Dharmsala, 5,000 ft., Mr. H. Whistler, secured a half grown ♀ (No. 25.10.2.5), dated June 21, which also has the face dominantly grey, the sides of the muzzle, a ring round the eye and a short stripe above it alone being brown; the nape and shoulders are dusky black, with no pale speckling and the coat is tolerably full, soft and about 40 mm. long.

An adult from Simla (*A. O. Hume*), referred by Blanford to *grayi*, has a thin, loose, long coat about 150 mm. as in the examples from Gharial and Sopur which it generally resembles in colour, but the narrow white band on the crown is continued backwards on to the nape and the pale areas of the mask are duller, not so whitish grey, and the patches above and below the eye, although large, are separated from each other and form the grey of the preaural fringe. In its less conspicuous mask pattern this specimen is transitional to *grayi*.

The available material of this race is unfortunately scanty. All the adult or subadult skins are undated and unmeasured, but in all the coat is long and loose, at least as long as in the best skins of *grayi* but with shorter, less luxuriant underwool. And this applies to the only reliably dated skin, that of the immature ♂ with milk-teeth, collected at Chamba on January 5th, when the coat should be nearly at its best. The only known skulls, however, those of the type and topotype are a little longer than skulls of *grayi* from Nepal. Hence the inference that *wroughtoni* is typically rather larger than *grayi*.

### PAGUMA LARVATA GRAYI, Bennett.

*Paradoxurus grayi*, Bennett, *Proc. Zool. Soc.* 1835, p. 118; Blanford, *Proc. Zool. Soc.* 1885, p. 803; and *Mamm. Brit. Ind.*, p. 112, 1888 (in part).

*Paguma grayi*, Gray, *List Mamm. Brit. Mus.*, p. 54, 1843;

*id. Proc. Zool. Soc.* 1864, p. 541; and of most subsequent authors (at least in part).

*Paradoxurus nipalensis*, Hodgson, *Asiat. Res.*, xix, p. 76, 1836.

*Locality of type* of *grayi*: 'India'.

*Locality of type* of *nipalensis*: Nepal, mainly the hilly region (Hodgson).

A little smaller than *wroughtoni*, judging from the size of the skull, and with the underwool of the winter coat longer and more luxuriant so far as the available skins indicate. Also in the traditionally typical form from Nepal further distinguished by the profuse pale speckling on the hairs of the nape and fore shoulders, which, instead of being blackish and contrasted with the back and loins as in *wroughtoni*, are nearly the same general hue; and by the duller, less silvery grey tint of the pale facial pattern. This last feature may, however, be due to soiling in the Nepal skins, which have been nearly a century in the Museum; and in some skins from Kumaon the nape is almost as black as in the typical form of *wroughtoni* from Murree and Kashmir.

The type of this race (B.M. No. 55.12.24. 232), ticketed 'India' Zool. Soc., was, judging from its skull, a menagerie-reared specimen, and since the abdomen is creamy white I sex it as a female. Since, moreover, it resembles one of Hodgson's Nepal specimens more closely than it resembles any other skin from 'India' I have seen, I accept the traditional identification of Hodgson's specimens as *grayi*. The coat is full and soft, the long hairs being about 38 mm. and the wool about 24 mm., thus agreeing very closely with Hodgson's description of the coat of *nipalensis* which he said was 1½ inches long (=40 mm.) with the wool 1 inch (=25 mm.). But the general tint of the hind-back, rump and tail is more buffy than in most of Hodgson's specimens, many of the hairs being not perceptibly dark at the tip, and the tail, complete or nearly so, is tolerably uniformly buffy throughout. On the fore-back, shoulders and nape the pale speckling in the hairs becomes gradually greyer and the black speckling more evident. The pattern of the face is fairly well defined, the greyish buff fronto-nasal band, paler on the forehead, being defined above by a streak running up from the corner of the eye, separating it from the greyish superciliary patch which nearly blends with the grey hue of the preaural fringe; the subocular patch is large but indistinctly defined posteriorly.

*Specimens from Nepal*: In the British Museum there are six skins, ticketed 'Nepal', which on account of their thick coats I judge to be early or late winter skins. All are without measurements and unsexed, but most of them I have sexed by the glandular area. Three belong to Hodgson's collection. A ♀ (No. 43.1.12.118) very closely matches the type of *grayi*, but is not quite so buffy and is more distinctly dark speckled on the hind back and tail, the tail being all dark in its distal half. The coat is thick with underwool and about 40 mm. long. A second ♀ (No. 45.1.8.296) has greyer speckling than the last, almost silvery grey on the fore quarters, the coat is 43 mm. long and equally thick.

A young, unsexable flat skin is speckled grey and black, the coat being 46 mm. long. Two adult ♂ skins (Mrs. Warren, Nos. 167 *a* and *b*) are tolerably uniformly speckled buffish grey and brown above, with the belly grey, not creamy white. In one the coat is 41 mm., in the other 47 mm., the wool being respectively 21 and 25 mm. A subadult ♂ (Dhuleep Singh, No. 55.1.20.10) has abundance of black speckling on the back, with the belly grey, and a very luxuriant coat, the long hairs 50 mm. and the wool about 35 mm. Another ♂ (Wormald, No. 88.10.25.1) ticketed 'Himalayas', is very like the last but rather more richly buff tinted posteriorly. The long hairs of the coat are also about 50 mm. and the wool about 31 mm. These two specimens approach *wroughtoni* in the black pigmentation of the neck; but have the pattern of the mask comparatively dull as in all the Nepal specimens previously referred to. Otherwise the mask is variable, resembling that of the type in some, but in others the pale areas encroach over the forehead and cheek which are dull, but rich grey, only the sides of the muzzle and the lower cheek being brown.

From the above given description it will be seen that the coat varies in length from about 40 mm. to about 50 mm., the latter, as exemplified in Dhuleep Singh's skin, representing, I assume, the complete winter coat of February and March. But four additional skins in Hodgson's collection have comparatively short coats with scanty underwool and these on the average are darker tinted than the longer coated forms. Blanford took them for a lowland variety of *grayi;* but since several of them are obviously moulting, I have no doubt they are 'summer' skins. One of them, apparently ♂ (No. 45.1.8.297) was chosen by Thomas as the type of *nipalensis*. But the choice was not very happy, since the coat is short and thin, not agreeing with Hodgson's description. The pale speckling is richer buff than in the thick coated skins. The remaining three are ♀ skins with two pairs only of large teats indicating the suckling of young. One (No. 58.6.24.57) is a poor, shabby skin in moult, very like the skin selected as the type of *nipalensis*, but tolerably uniformly speckled with ochreous above. Another (No. 58.6.24.58) is in moult like the last, but is a darker specimen, with a good deal of blackish brown ochreous speckling on the back. The third (No. 58.6.24.40) is also moulting, with the new coat erupting on the neck and shoulders. It may be described as a 'rufescent' variety, the whole dorsal surface being richly speckled with rusty ochreous, with the belly rich ochreous buff, especially round the gland, on the back of the thighs and on the root of the tail; even the pale areas of the mask are tinted with buff. In none of these short-coated specimens is the pattern of the mask strongly contrasted.

*Specimen from Kumaon*: Skins from this state resemble those from Nepal, identified as *grayi*, in the size of the skull and the length and luxuriance of the underwool of the winter coat, but some of them have the nape as black as in *wroughtoni*, and in this respect are annectant forms. Two ♂ examples collected for the Survey by Crump at Dhakuri, 9,000 ft., on September 19th. and

21st. are of special interest. The coat is long and thick, as good as in the best skins assigned to *grayi*, although judging from the time of the year it had not attained full growth. It is much fuller and closer than in the skin from Deolah, Chamba, January 5th. They are darkish skins with abundance of black speckling in the pelage; one is about as black on the nape as in *wroughtoni*, although this area is not so strongly contrasted with the back; the other is not so black on the nape and has the pale speckling on the body more ochreous than the first.

A skin from Swarkot, 3,569 ft. (*C. A. Crump*), August 21st., is moulting, with most of the long hairs gone; the nape is blackish as in *wroughtoni*. Two from Naini Tal (E. A. Smithies), on the contrary, have the neck gray as in *grayi*; in one the coat is long and loose as in *wroughtoni*, in the other it is thin and short, only about 25 mm. long. The skin of an old, but suckling ♀ collected by Col. C. H. Stockley on July 3rd in Eastern Kumaon, also has the neck grey; the coat is thin, short and in moult and the belly is cream or pale buff, as is commonly the case in suckling females.

Skull measurements of *wronghtoni* and *grayi*.

| | In English Inches. | | | | | In Millimetres. | | |
|---|---|---|---|---|---|---|---|---|
| Locality and Sex | Total length | Zygom width | Waist width | Int. orb. width | Max width | Bulla | $Pm^4$ | $M^1$ |
| *wroughtoni* | | | | | | | | |
| Murree, Upper Punjab (type) old ♂ ... | 5·0 | 2·8½ | ·9½ | 1·0 | ·9½ | 16–17 | 8 × 6 | 6 × 7 |
| ,, ,, yg. ad. ♀ | 4·7½ | 2·5½ | ·8 | ·9– | ·9 | 19– | 9 × 6 | 6 × 7 |
| *grayi* | | | | | | | | |
| Dhakuri, Kumaon ad. ♂ | 4·6 | 2·6 | ·9 | ·9+ | ·9+ | 17 | 8 × 6½ | 6 × 6½ |
| ,, ,, yg. ad. ♂ | 4·5½ | 2·3½ | ·8½ | ·8 | ·8 | 17 | 7 × 6 | 6 × 7 |
| E. Kumaon (Stockley) old ♀ | 4·7½ | 2·5½ | ·8 | ·9 | ·9 | 18 | – | – |
| Naini Tal ... ad. ♀ | 4·6½ | 2·4 | ·9 | ·8+ | ·8½ | 17 | 8 × 5½ | 6 × 7 |
| 'India' (type) yg. ad. ♀ | 4·5½ | 2·3½ | ·9 | ·9 | ·9 | 18 | 7 × 6 | 6 × 7 |
| Nepal (58.6.24.40) ad. ♀ | 4·7 | 2·7½ | ·8 | ·9+ | ·9+ | 19 | 9 × 6 | 7 × 8 |
| Nepal (43.1.12.118) ad. ♀ | 4·4½ | 2·6 | ·9 | ·9 | ·8½ | 16½ | 7½ × 5½ | 6 × 7 |
| ,, (45.1.8.296) ad. ♀ | ... | 2·4 | 9· | ·8½ | ·8½ | 18 | 8 × 5½ | 7 × 7½ |

This table shows the slight superiority in size of the skulls of *wroughtoni* over those of *grayi*. The skull of the ♂ (type) of *wroughtoni* is old, even most of the facial sutures being obliterated and the teeth a good deal worn; but, despite its age the temporal ridges merely meet without forming a definite sagittal crest. The bullae vary in size, both being smaller than those of the smaller and younger ♀ skull, which has the basi-occipital suture still unfused and the temporal ridges 9 mm. apart on the parietals. This skull is a trifle longer than the largest of the ♀ skulls of typical *grayi* from Nepal, although considerably younger, and closely resembles in all its dimensions the old skull from E. Kumaon (Stockley), which has the teeth too worn for useful measurement. This skull also has no sagittal crest, the ridges not quite meeting on the crown, being 4 mm. apart at their widest. In the first adult ♀ from Naini Tal they are 9 mm. apart. The only skull of this series, indeed, which has a distinct, though low, crest is the oldish ♀ skull from Nepal (58. 6. 24. 40), belonging to the short-coated rufescent skin above described. It is on account of the general agreement in size between the skulls from Kumaon and Nepal that the former are assigned to *grayi*, although the skins of the specimens from Dhakuri as well as the one from Swarkot, might be taken for *wroughtoni* from the blackness of the nape.

### PAGUMA LARVATA NEGLECTA sub-sp. nov.

*Paradoxurus grayi*, Blanford and *Paguma grayi*, Wroughton (in part).

*Locality of type*: Mokokchung, Naga Hills, Assam.

*Distribution*: Assam thence southwards to the Chin Hills and Arakan in Burma, and apparently westwards to Darjiling and the low lying districts of Nepal.

Resembling typical *grayi* of the hilly districts of Nepal in the uniformly coloured dorsal surface from the crown to the tail, but differing in its noticeably shorter and less luxuriant winter coat. The proximal portion of the tail is also on the average more brightly ochreous in examples from the districts to the east of the Brahmaputra.

The type, a subadult ♂, unmeasured, from Mokokchung in Naga Hills, 4,500 ft. (*H. W. Wells*, B.M. No. 21.8.2.7), collected in April, before the early summer moult, has the coat about 38 mm. long and moderately thick with underwool. The dorsal surface from the crown of the head to the root of the tail is well coloured with black and buff speckling, the buff being richer on the hind body and rump than anteriorly. The tail is rich ochreous buff proximally, the hairs mostly without black tips, paler buff with black tips distally, the terminal two inches black. The legs are externally grizzled and the underside is whitish from the black chin to the anus. The mask is well defined, dark brown and mostly clear silvery grey; the naso-frontal band, speckled black and white on the forehead and over the eyes, passes over the crown to blend with the buffy grey of the nape and between the eye and the ear it is confluent with the speckled superciliary patch which itself blends with the whitish of the preaural fringe, so that there is a continuous well-defined pale band running across the forehead, in front of the ears on to the throat, the subocular patch is large and conspicuous on the dark brown of the cheek.

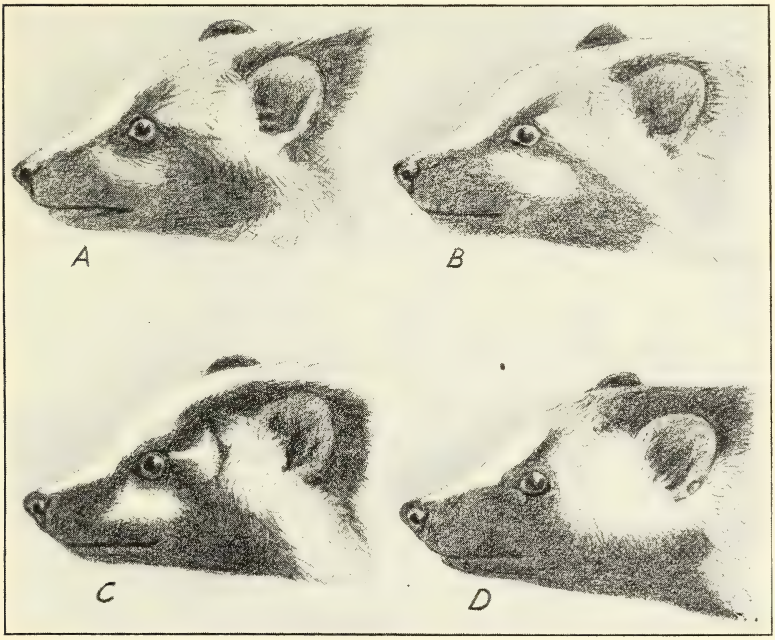

Fig. 6.—*A*. Head of *Paguma larvatus wroughtoni* from the Upper Punjab. *B*. Head of *P. l. neglecta* from the Naga Hills. *C*. Head of *P. l. intrudens* from Myitkyina, Upper Burma. *D*. Head of *P. l. janetta* from Tenasserim.

A ♂ from Duragiri in the Garo Hills 3,000 ft. (*H. W. Wells*), March 21st., has the coat almost as in the type but a little shorter, about 35 mm long. The general colour is not so rich, the pale speckling being greyer, less buff, and the black and grey speckling everywhere finer; the tail also is not so bright. The pattern of the mask is not so contrasted, the forehead and superciliary patch being more grizzled and this patch is separated from the frontal band by the upward extension of the stripe above the eye to join the circumaural brown area, but is broadly confluent with the white of the preaural fringe and collar behind the cheek; the subocular patch is smaller and less conspicuous.

A flat, unmeasured skin from Dening in the Mishmi Hills in N.E. Assam, 2,250 ft. (H. W. Wells), April 22nd. has the coat thickish but short, about 31 mm. The general coloration is very much as in the type from the Naga Hills but the mask is not so white, more as in the Garo Hill specimen, but the tail is rich ochreous proximally.

I also refer to this race three badly preserved skins procured by J. M. D. Mackenzie in the Chin Hills, 4,000 ft., 150 miles west of Kindat in Upper Burma, some 200 miles south of Mokokchung. They are dated April 22nd., but this only signifies the day of their receipt from natives. Two of them are richly tinted like the type one with noticeably ochreous tail, and have the coat 34 and 38 mm. long; the third has longer hair, about 40 mm., and is greyer as if bleached.

No doubt Blanford's record of *grayi* from Arakan referred to this race, which, so far as known, has a north and south extension of some 500 miles to the west of the Chindwin River and Lower Irrawaddy. Its distribution helps to explain the otherwise rather puzzling general likeness between the Himalayan *grayi* and the Andaman Island race *tytlerii*.

Evidence for the extension of this race north-west of the Brahmaputra, even into Nepal, where doubtless it blends with typical *grayi*, is supplied by the following skins:—

Two from comparatively low altitudes in the Nepal Valley collected for the Survey by N. A. Baptista, a young adult ♂ with no skull, at Thankot on May 14th., and an adult ♀ at Hathiban on May 25th. The coat is not luxuriant with underwool and is shortish, about 36 and 38 mm. long, with the pale areas of the hairs, possibly due to bleaching before the moult, clearer, more silvery grey than in the Nepalese skins identified as *grayi*, and the pattern of the mask more sharply defined, the dark areas being blacker and the pale areas whiter grey, as in the type of *neglecta* from the Naga Hills, but the pale speckling is greyer, not so buff and the proximal portion of the tail is not richly tinted.

There are also two skins from Darjiling. One an adult ♂ collected for the Survey by Crump at Narbong, 2,000 ft., on March 9th. The coat, which from the date should be at its best, is only 35 mm. long and not nearly so thick as in the long and thick coated examples of *grayi* from Nepal and Kumaon. The general colour is considerably darker than in the type and in Baptista's specimens, owing to the fine pale speckling of the long hairs, which is mostly silvery grey with a buffish wash on the middle line of the back. It more resembles the example from the Garo Hills; but the facial pattern is more strongly contrasted as in Baptista's specimens. The second from the Gopaldhana Valley (H. Stevens, No. 19. 7. 26. 5), January 12th., is not definitely assignable either to *grayi* or *neglecta*, but may be regarded as an annectant type. The general coloration is much as in *grayi* and the winter coat is about as long, but it is softer and has much thinner underwool than the best coated skins of *grayi* from Nepal and Kumaon. In neither of these Darjiling specimens is the tail noticeably ochreous proximally.

The following are the only available flesh measurements, in English inches, and weights of specimens, referred to the three races, *wroughtoni*, *grayi* and *neglecta*, described above. To these is added the length of the coat in millimetres.

| | In English Inches. | | | | |
|---|---|---|---|---|---|
| Locality, Date and Sex | Head and Body | Tail | Hind foot | Weight | Coat in mm. |
| *wroughtoni.* | | | | | |
| Deolah, Chamba, 6,000 ft. Jan. 5. immat. ♂ | $19\frac{3}{5}$ | 20 | 3 | ... | 54 |
| *grayi.* | | | | | |
| Dhakuri, Kumaon, 9,000 ft. Sept. 21. ad. ♂ | $25\frac{3}{5}$ | $24\frac{1}{3}$ | 4+ | $11\frac{1}{2}$ lbs. | 51 |
| Do. Sept. 19 ; yg. ad. ♂ | $23\frac{2}{5}$ | $22\frac{1}{2}$ | 4− | $8\frac{1}{4}$ ,, | 53 |
| *neglecta.* | | | | | |
| Hathiban, Nepal, May 25th. ad. ♀ | $24\frac{4}{5}$ | $24\frac{4}{5}$ | $3\frac{4}{5}$ | 11 lbs. | 36 |
| Thankot, Nepal, May 14th. yg. ad. ♂ | $23\frac{1}{5}$ | $23\frac{3}{5}$ | $4\frac{1}{6}$ | ... | 38 |
| Narbong, Darjiling, March 9. ad. ♂ | $25\frac{4}{5}$ | $23\frac{2}{5}$ | $4\frac{1}{8}$ | $9\frac{1}{2}$ lbs. | 35 |
| Duragiri, Garo Hills, March 21. ? ad. ♂ | $24\frac{4}{5}$ | 24 | $3\frac{4}{5}$ | $5\frac{1}{2}$ ,, | 34 |

In the measurements of the head and body, tail and hind foot there is little to choose between the specimens; but the table brings out clearly the difference in the length of the winter coat between the western specimens from Chamba and Kumaon and the eastern from Darjiling and the Garo Hills. In reality the difference is probably greater than the figures indicate. The example of *wroughtoni* from Chamba is a male with milk teeth, killed in January. One would expect the coat of the adult in March to be still longer, also it is safe to claim that the September coat of the specimen from Kumaon would have been considerably longer by March. On the other hand, in the specimens from Darjiling and the Garo Hills, killed in March, the coat may be regarded as having reached its full growth. The coat of the examples from Hathiban and Thankot in Nepal, killed in May, is more doubtful. In both the underwool is thin from the moult; but the long hairs seem to be those of the winter coat bleached grey. In that case they resemble in length those of *neglecta*.

## PAGUMA LARVATA TYTLERII, Tytler.

*Paradoxurus tytlerii*, Tytler, *Journ. As. Soc. Bengal* 33, p. 188, 1864; Blanford; *Proc. Zool. Soc.* 1885, p. 805, and *Mamm. Brit. India*, p. 113, 1888 (referred to *Paradoxurus grayii*), Miller, *Proc. U.S. Nat. Mus.* 24, p. 772, 1902.

*Locality of type*: Port Blair; S. Andaman Island.
*Distribution*: Andaman Islands.

A shorter coated race than the northern mainland forms, also smaller judging from the skull and the recorded body measurements, and pale tinted, the dorsal pelage speckled grey and black, and tolerably uniformly from the crown to near the end of the tail; The 'mask' but little differentiated, its pale areas grey, like the nape and back, and the dark areas pale brown.

There are three skins of this race in the British Museum; a female unmeasured and without skull, from Rutland Island (C. G. Rogers 6.9.1.3), April 4th., has a short thin coat, 18 mm. long, the colour of the upper side is tolerably uniformly dark grey, due to a mixture of black and grey speckling, and the under side white; the tail is mostly the colour of the back, but becomes blackish grey in its terminal third; the 'mask' is indistinct, grey and brown, grey, matching the body, on the preaural fringe, the superciliary patch, the forehead and the midline of the nose, brown on the sides of the muzzle and the lower cheeks.

A young ♂, with skull but unmeasured and merely ticketed Andamans (A. O. Hume; No. 85.8.1.30), has a longer coat, 26 mm. with more underwool than the last and is rather better tinted owing to the black and grey areas of the hairs being more extensive, and the tail is not appreciably darkened at the end.

The third skin belonging to the mounted specimen mentioned by Blanford is dull coloured, probably faded, and in moult.

Miller's specimen, like the type, came from S. Andaman Island. It was an adult ♂ measuring: head and body 22 in., tail 19⅘ in., hind foot 3⅓ in. The type, according to Tytler, was very nearly the same, namely head and body 21 in., tail 20 in., but whether adult or not is unknown. Miller did not describe his specimen apart from the record of its dimensions in the flesh and of the skull.

There are two skulls in the British Museum of which the dimensions are as below, together with the corresponding dimensions, where available, of Miller's specimen.

Skull measurements of *neglecta* and *tytlerii*.

| | In English. | | | | | In Millimetres. | | |
|---|---|---|---|---|---|---|---|---|
| Locality and Sex | Total length | Zygom. width | Waist width | Int. orb. width | Max. width | Bulla | Pm$^4$ | M$^1$ |
| *neglecta.* | | | | | | | | |
| Hathiban, Nepal. ad. ♀ | 4·6 | 2·5 | ·8+ | ·8½ | ·9− | 18 | 9− × 6 | 7 × 8 |
| Narbong, Darjiling. oldish ♂ | 4·8 | 2·7 | ·9 | ·9 | ·9 | 19 | 8½ × 7 | 7 × 8 |
| Naga Hills, Assam (type). yg. ad. ♂ | 4·9− | 2·7½ | ·9 | ·9 | ·9+ | ... | 8½ × 6 | 7 × 8 |
| Chin Hills, Burma oldish (?) ♂ | 4·8½ | 2·8½ | ·9 | ·9 | ·9½ | ... | 9 × 7½ | 7 × 8 |
| *tytlerii.* | | | | | | | | |
| Andamans. old (?) ♂ | 4·4 | 2·7 | ·7 | ·8 | ·8+ | 17 | 7 × 6 | 6½ × 8 |
| Andamans. young ♂ | 4·3½ | ... | ·8 | ·8 | ·8 | ... | 8 × 5½ | 6 × 7 |
| S. Island, Andamans (Miller) ad. ♂ | 4·2½ | 2·4 | ... | ·8½ | ... | ... | ... | ... |

With regard to the skulls assigned to *neglecta* it is noticeable that the ad. ♀ skull from Hathiban has no sagittal crest, the temporal ridges being 9 mm. apart and that in the oldish male skull from Narbong they are 5 mm. apart; thus agreeing with the skulls of *grayi* and *wroughtoni*, which seem rarely to develop the crest. In both the ♂ skulls from the east of the Brahmaputra, on the contrary, there is a definite sharp sagittal crest, even in the type-skull from the Naga Hills, which is not quite fully developed.

The two skulls of *tytlerii* in the British Museum are a little but not very much smaller than those of the other races.

The first on the list (Zool. Soc. No. 70.12.17.1) is unsexed and was extracted from the mounted specimen referred to by Blanford. It is old, with worn teeth, and even the facial sutures obliterated; the sagittal crest is 3 mm. high, the post-orbital area, or 'waist' unusually narrow, and the post-orbital processes long. These features combine to make it more like the skull of *Paradoxurus* than any skull of *Paguma* I have seen. But it cannot be regarded as typical of *tytlerii* because, coming from the Zoological Society, it is probably a menagerie-reared skull. The second, belonging to Hume's specimen, is young, with all the milk teeth in place, but the first molar is through the bone and the permanent canines are showing. For measurement the 4th upper premolar of the permanent set was cut out of the maxilla. It will be noticed that this skull, despite its immaturity, is longer than that of the adult topotypical ♂ from South Island, recorded by Miller.

## PAGUMA LARVATA INTRUDENS.

*Paguma larvata intrudens*, Wroughton, *Journ. Bomb. Nat. Hist. Soc.*, xix, p. 793, 1910; id. op. cit., xx, p. 51, 1918; Thomas, *Ann. Mag. Nat. Hist.* (9), viii, p. 617, 1921; G. M. Allen, *Amer. Mus. Novit.*, No. 359, p. 7, 1929.

*Paguma larvata vagans*, Kloss., *Journ. Nat. Hist. Soc., Siam*, iii, p. 73, 1919.

*Paguma larvata yunalis*, Thomas, *Ann. Mag. Nat. Hist.* (9), viii, p. 617, 1921.

*Locality of type of intrudens*: Sima in Myitkyina, Upper Burma.
,, ,, ,, *vagans;* Sikawtur, N.-W. of Raheng, W. Siam.
,, ,, ,,*yunalis;* Yenguensien in S. Szechwan.

*Distribution*: From S. Szechwan, Yunnan and N.-E. Burma to Laos, Tonkin, the Shan States and Siam.

*Note on the synonymy*: Wroughton distinguished the Burmese specimens he named *intrudens* from a series of specimens from S. Szechwan and Yunnan, which he identified as typical *larvata*, by the extension of the white crest over and beyond the withers and by their generally paler tint. Accepting this difference Thomas subsequently named the Szechwan and Yunnan specimens *yunalis*, separating this race from *larvata* by its better colour. But G. M. Allen, who had a fine series of typical *larvata* from S. China and several skins from the districts whence *yunalis* was recorded, showed that the characters relied on by Wroughton and Thomas have not the value assigned to them. He therefore united *yunalis* with *intrudens*, pointing out that the specimens to which these names were given represent a race differing from typical *larvata* merely by its slightly superior size. My examination of the skins and skulls seen by Wroughton and Thomas confirms Allen's conclusion. My reason for adding *vagans* to the synonymy is given below.

*Description*: Distinguished from the Himalayan and Andamanese races, hitherto considered, by the more sharply contrasted black and white pattern of the 'mask', combined with the extension of the median white area of the crown along the nape to the withers, or beyond, and its conspicuousness owing to the blackness of those areas. Resembling in those respects typical *larvata* of southern China; but a little larger.

There are three Burmese examples of this race in the British Museum. A young adult ♀ (type) from Sima in Myitkyina, 4,500 ft., near the western border of Yunnan (A. W. Kemmis, No. 9.7.20.6), November 9th. General colour of the dorsal surface and flanks dull buff, speckled with black, the black more in evidence on the shoulders than behind them; neck still blacker but with a broad white median band continuous in front with the band on the crown and passing on to the withers where it is interrupted, but re-appears for a few inches behind them. Lower surface mostly white, the hairs grey at the base; more grey on the chest, throat white behind, black, like the chin, in front. Tail like the back in its proximal portion; distally black. Mask, as above described, with a broad median white band from the top of the muzzle over the crown, a large subocular white patch; superciliary patch also tolerably large and only narrowly separated from the preaural fringe, the white of which is broadly continuous below the ear with the white throat-collar; the rest of the face jet black, emphasising the white.

Two examples from Pyaunggaung in the North Shan States, 2,794 ft. (*G. C. Shortridge*, No. 14.7.8.61 and 62). An immature ♀, May 11th, is practically identical with the last, with the coat a little longer but thinning from the moult. An adult ♂, April 30th, also has the coat thinner than in the type owing to the moult, most of the long hairs being shed on the neck. The general colour is a richer, more golden buff than in the others, with less black speckling because most of the hairs have no black tips, a feature common in Chinese specimens, although small black tips are present on the shoulders. The white median stripe on the nape owing to the shortness of the hairs is much narrower and does not reach the withers; the mask is very similar but the superciliary patch is confluent with the white of the preaural fringe. The tail is grey, except at the base, and the legs are brown, speckled with grey, with black toes, not mainly black as in the two females.

The variations between these skins of *intrudens* have an important bearing on the status of the supposed race *vagans* based upon a single female without the skull, said to differ from *intrudens* by the tips of the hairs being black instead of buff, the white nape stripe not extending on to the withers, the superciliary and preaural white patches confluent, the under side cream and the hind legs ochreous on the inner side. But in the type of *intrudens* the hairs are black tipped; in the ♂ from the N. Shan States the nape stripe falls short of withers, and the two white areas on the head are confluent; in both the females of *intrudens* there is some ochreous on the inner side of the hind legs and the colour of the belly is known to vary individually from white or grey to cream in races of *Paguma*, cream, as above pointed out, being common in females.

In the following table are entered the dimensions, in English inches, and the weight, of the only examples of *intrudens* in the British Museum, measured in the flesh, and those of the type of *vagans* recorded by Kloss. To these have been added the length of the coat in millimetres.

| | In English Inches. | | | | |
|---|---|---|---|---|---|
| Locality, Date and Sex | Head and Body | Tail | Hind Foot | Weight | Coat in mm. |
| N. Shan States; April 30; yg. ad. ♂ | 27⅕ | 24⅖ | 4½ | 11 lbs. | 37 |
| N. Shan States; April 30; immat. ♀ | 22⅖ | 21⅘ | 4⅕ | 6½ ,, | 48 |
| Myitkyina (type of *intrudens*) Nov. 9; yg. ad. ♀ | 24 | 23 | 3⅖ | ... | 41 |
| Hills N. W. of Teng-yueh, Yunnan; Aug. ad. ♀ | 26⅕ | 24⅕ | 4 | ... | 45 |
| Nape, Laos. Jan. ad. ♀ | 25 | 23⅘ | 3¾ | ... | ... |
| N.W. of Raheng, Siam (type of *vagans*) ? ad. ♀ | 24⅕ | 23 | 3 | ... | ... |

Measurements of the three available skulls of Burmese examples of *intrudens*. The second on the list carries complete milk dentition.

| | In English Inches. | | | | | In Millimetres. | | |
|---|---|---|---|---|---|---|---|---|
| Locality and Sex | Total length | Zygom. width | Waist width | Int. orb. width | Max. width | Bulla | $Pm^4$ | $M^1$ |
| N. Shan States; yg. ad. ♂ | 4·7 | 2·5½ | 1·0 | ·9+ | ·9+ | 19 | 9 × 6 | 7½ × 8 |
| N. Shan States; immat. ♀ | 4·4 | 2·2 | ·8 | ·8 | ·8 | 18½ | ... | ... |
| Myitkyina (type) yg. ad. ♀ | 4·6 | 2·5 | ·8+ | ·8½ | ·9− | 17 | 8 × 6 | 7 × 7 |

These measurements agree very closely with those of the skulls from Szechwan, Yunnan and Indo-China assigned by Thomas to *yunalis* and with the average of 4.7 in. in total length given by Allen for skulls of this race from Szechwan and western Yunnan. He found, on the contrary, that the average total length of a number of adult skulls of typical *larvata* from Fokien in S. China was only 4.4½ in., indicating the smaller size of the latter race.

### PAGUMA LARVATA ROBUSTA, Miller.

*Paradoxurus robustus*, Miller, *Proc. Biol. Soc. Wash.*, xix, p. 26, 1906.

*Paguma robusta*, Kloss, *Journ. Str. Br. R. Asiat. Soc.*, No. 53, p. 24, 1909.

*Paguma leucomystax robusta*, Wroughton, *Journ. Bomb. Nat. Hist. Soc.*, xxvi, p. 51, 1918.

*Locality of type*: Trong or Trang, Peninsular Siam (Lat. 8° N.).

*Distribution*: Tenasserim, Peninsular Siam, Northern Malay Peninsula.

Distinguished from the more northern races by an average slight superiority in size and by the shortness and thinness of the coat at all seasons of the year, but principally by the large size and conspicuousness of the cream or white area of the cheek in front of the ear resulting from the forward sweep of the short hairs of the preaural fringe to form, where they meet the backwardly directed hairs of the rest of the face, a curved crest which passes only a short distance behind the eye. The general colour, hardly differing from that of some examples of *grayi* or *tytlerii*, varies from paler or darker tawny to buffy grey, the back sometimes with rusty ochreous speckling, but black or dark brown speckling of the coat on the back is never conspicuous, but usually more pronounced anteriorly, the nape sometimes being brownish. The pale fronto-nasal band is conspicuous and may be practically uniformly tinted throughout and fuse with the preaural patch or darkened between them; it may stop short on the crown between the ears or be continued on to the anterior portion of the nape; the rest of the mask is brown with the subocular patch represented at most by a grey smear; the belly is pale, creamy or greyish.

This description is based upon five examples collected by Kloss in Peninsular Siam and the northern parts of the Malay Peninsula, one of them, a large old ♂, being a topotype from Trang.

The evidence that this race comes into the fauna of British India rests upon the record by Miller of a specimen from Telok Besar in Tenasserim. This was an adult ♂, a little smaller than the type of the race, an adult ♀ from Trang, and much smaller, almost 5 inches shorter in the length of the head and body, than the topotypical ♂ above referred to. Miller did not give the measurements of the skull of the example from Telok Besar, but supplied those of the body taken in the flesh. In its size, the pattern of the mask, and in its skull this race resembles the long-known southern race *leucomystax* found in the southern Malay Peninsula, Sumatra and Borneo, but is much paler in general coloration, in which it is very like *grayi*. It is one of the annectant forms above referred to, justifying the view that *leucomystax* is a subspecies of *larvata*.

### PAGUMA LARVATA JANETTA, Thos.

*Paguma robusta*, Wroughton, *Journ. Bomb. Nat. Hist. Soc.*, xxiii, p. 710, 1915 (not *Paradoxurus robustus*, Miller).

*Paguma leucomystax janetta*, Thomas, *Ann. Mag. Nat. Hist.* (10), ii, p. 101, 1928.

*Locality of type*: Bankachon, Victoria Pt., S. Tenasserim.

*Distribution*: S. Tenasserim.

Distinguished from *robusta*, which it resembles in its short, thinnish winter-coat, large white or cream preaural area and some cranial features, by its much darker colour, the back being speckled with black and ochreous or buff, passing into grey on the flanks, but the pale speckling dies out on the shoulders and nape which are brownish black, with at most some white, continued back from the crown, in the middle of the nape.

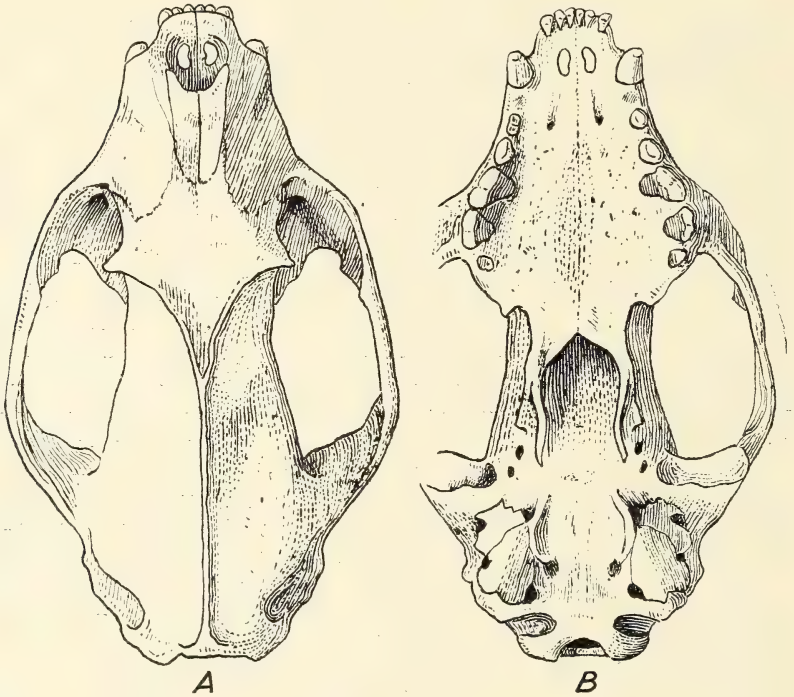

Fig. 7.—*A*. Upper and lower side of skull of oldish male (type) of *P. l. janetta* from Bankachon, Tenasserim.

The British Museum has three examples of this race collected for the Survey by G. C. Shortridge in Victoria, Tenasserim. They must have been assigned originally to *robusta* on geographical grounds without regard to Miller's description of that race. The type, an adult ♂ (No. 14.12.18.111) has no white on the nape or crown, no subocular patch, the grey fronto-nasal band narrowly continuous with the large preaural area and a pale brownish chin.

An adult ♀ (No. 14.12.8.112) is a little paler on the upper side, the black speckling being less evident, the pale speckling more ochreous on the back and more buffy on the flanks; the fore part of the under side is darker grey, the chin blackish; there are a few speckles on the crown and an indistinct grey subocular patch. A more interesting difference lies in the preaural fringe, the hairs of which do not grow so far forwards, their disposition being intermediate between those of the type and of the more northern races. A young ♂ with milk teeth is like the adult ♂, but has a quantity of white on the nape, some on the crown and clean white facial areas, with the fronto-nasal band more clearly separated from the large preaural patch, and the chin black.

The following table gives the flesh measurements in inches and the coat in millimetres of the example of *robusta* from Tenasserim and of the three specimens of *janetta*:—

| | English Inches. | | | | |
|---|---|---|---|---|---|
| Locality, Date and Sex. | Head and Body. | Tail. | Foot. | Coat in millim. | Weight. |
| *robusta.* | | | | | |
| Telok Besar, Tenasserim (Miller). ad. ♂ | $25\frac{3}{5}$ | $22\frac{3}{5}$ | 4 | ... | ... |
| *janetta.* | | | | | |
| Bankachon, Tenasserim; Dec. 12; ad. ♂ | $26\frac{1}{5}$ | ... | $4\frac{2}{5}$ | 20 | $12\frac{1}{2}$ lbs. |
| Bankachon, Tenasserim; Dec. 27; immat. ♂ | $23\frac{1}{5}$ | $20\frac{4}{5}$ | 4 – | ... | $6\frac{1}{8}$ ,, |
| Bankachon, Tenasserim; Dec. 29; ad. ♀ | $25\frac{2}{5}$ | 23 | 4 | 29 | $9\frac{1}{4}$ ,, |

According to this table there is nothing to choose between *robusta* and *janetta* in size; but the only two males of *robusta* I have seen, namely an old example from Trang, the typical locality, and a young adult from Klong Wong Hip, both in Peninsular Siam, are considerably larger being, respectively $30\frac{1}{5}$ and $29\frac{2}{5}$ inches in length of head and body. This suggests that the Tenasserim example of *robusta* serves in a measures to link *robusta* and *janetta*, resembling the former in colour, the latter in size. In four examples of *robusta* from Peninsular Siam and the northern part of the Malay Peninsula, collected in October, February and March, the coat varies in length from 23 to 31 mm., which is about the same as in the examples of *janetta* collected in December. Both these races closely resemble *tytlerii* of the Andamans in the coat; but have it shorter than in *neglecta* and *intrudens* found farther north in British Burma. Typical *robusta* seems to be a little larger than *intrudens* and *neglecta;* the Tenasserim *robusta* and *janetta* seem to agree fairly well with those two races in size.

Skull measurements of *janetta*.

| | In English Inches. | | | | | In Millimetres. | | |
|---|---|---|---|---|---|---|---|---|
| Locality and Sex. | Total length. | Zygom. width. | Waist. width. | Int. orb. width. | Max. width. | Bulla. | Pm$^4$. | M$^1$. |
| Bankachon, Tenasserim (type) ad. ♂ | 4·9 | 2·9½ | 1·1 | 1·1 | 1·0 | 19 | 9 × 6 | 8 × 8 |
| Bankachon, Tenasserim immat. ♂ | 4·4 | 2·3 | 1– | ·9 | ·9 | 17 | 8 × 6½ | 7 × 8½ |
| Bankachon, Tenasserim ad. ♀ | 4·6 | 2·5½ | ·9½ | ·8½ | 9·8½ | 19 | 8 × 6½ | 7 × 8 |

Judging from the flesh measurements, the skull of Miller's adult ♂ example of *robusta* from Tenasserim would not have exceeded in size that of the adult ♂ (type) of *janetta*. But the skull of the oldish ♂ of *robusta* from Trang above referred to, is 5.3½ in. long and 3 in. wide, and that of the adult ♀ (type), recorded by Miller, was 5 in. long and 2.7 in. wide, both being larger than the adult ♂ and ♀ skulls respectively of *janetta*, thus bearing out the conclusion derived from the flesh measurements that *robusta* is a larger form than *janetta*. The immature ♂ skull of the latter entered above carries its milk dentition, none of the permanent teeth being through the bone. The measured teeth were exposed by cutting away the maxilla.

The skulls of these two races are better developed muscularly than those of the preceding races. They exhibit a much more marked depression on the crown at the junction of the frontal and parietal bones and at this point the sagittal crest on the skull of the adult ♂ (type) of *janetta* is 5 mm. high, although in the adult ♀ there is no crest, the ridges being 5 mm. apart approximately, as in ♀ skulls of *grayi*. In skulls of *robusta* from Peninsular Siam the crest is still better developed. In an immature ♂, with milk teeth, the ridges just meet on the crown and in a young adult ♀ they rise into a low, sharp crest, as in the one oldish ♀ skull of *grayi* from Nepal.

# ON THE BIRDS OF THE ADUNG VALLEY, NORTH-EAST BURMA.

BY

N. B. Kinnear.

[*Assistant Keeper, British Museum* (*Natural History*).]

In 1930 Captain Kingdon Ward accompanied by Lord Cranbrook made an expedition to the sources of the Irrawaddy with the object of studying the flora and collecting seeds of plants for introduction into British gardens. In his previous expeditions to Burma and Southern Tibet Captain Kingdon Ward always endeavoured to collect a few birds, but naturally having first to pay attention to plants, only when not engaged in botanizing or seed collecting has he been able to secure birds. Any lack of numbers however, has been made up in the rarity of the specimens secured. For instance, during his 1922 expedition he collected examples of *Tetraophasis szechenzii* in Yunnan and in 1924 obtained both Temminck's Tragopan (*Tragopan temminckii*), and Sclater's Monal (*Lophophorus sclateri*), in Southern Tibet, while in 1926 he got several specimens of the Yunnan Blood Pheasant, a new Trogon (*Pyrotrogon wardi*) in the Seinghku Valley, N. Burma.

In the present expedition Captain Ward was singularly fortunate in having as a companion, Lord Cranbrook, who was able to devote himself almost entirely to collecting zoological specimens. It says a great deal for Lord Cranbrook's zeal as a collector that with no previous experience and only one or two lessons in skinning he brought back some 152 birds, 340 mammals, a number of reptiles—one of which was new—and a collection of insects. Among the mammals four have been found to be new to science and I have described two new races amongst the birds.

The interest in the collection however, does not lie in the discovery of new forms but in the addition to our knowledge of the distribution of certain species. Some of the birds were previously only known from Nepal and Sikkim and N.-W. Yunnan and were unrecorded from any intermediate locality. While others again were known from the Himalayas and Assam, but not from Burma or further East. A number of the species are new to Burma, but exactly how many it is difficult to say definitely. In the second edition of the bird volumes of the *Fauna of British India*, certain species are stated to occur in Burma, but neither Dr. Ticehurst, who has made a very complete bibliography of Burmese birds, nor I, have been able to trace any published record and there are no skins in the Museum from Burma.

The field notes made by Lord Cranbrook are distinguished by a (C) and those by Captain Kingdon Ward with (K. W.). All references to the *Fauna* should be understood as meaning the volumes by Mr. Stuart Baker in the second edition of the *Fauna of British India* series.

Out of the 152 skins in the collection 88 were presented by Lord Cranbrook and Captain Kingdon Ward to the British Museum, the remainder going to the Field Museum, Chicago.

Lord Cranbrook has kindly contributed the following account of the trip and the country visited.

## Narrative of the Expedition.

BY

Lord Cranbrook.

The object of Captain Kingdon Ward's 1931 Expedition was, of course, mainly botanical, though we hoped to cross the pass at the head of the

Nam Tamai valley into Tibet, and link up our route with that of any other traveller further north. I was to make as representative a collection as I could of the birds and mammals.

We arrived at Rangoon in November 1930 and proceeded to Myitkyina by train, travelling from there by mules to Fort Hertz, where we arrived on December 16th. Owing to the regulations of the Yunnan Government, Chinese mules working in Burma are not allowed east of the Mali Hka, so after leaving Fort Hertz we had to rely on coolies for transport. As the country is very sparsely inhabited and we were taking stores for a year, it meant that travelling was slow and that we were separated from part of our kit for days at a time, so it says much for the honesty of the inhabitants that, though we had about a hundredweight of coined silver, to say nothing of a case of rum bottles—which even empty were almost priceless to the natives—we never missed anything!

Between the Mali Hka and the Nam Tamai we had to cross three ranges of about 6,000 ft. dropping down to the valleys between each at about 1,500 ft.; the road, a good mule path, running through evergreen hill jungle. Reaching the Tamai on January 7th we travelled up its east bank, arriving at the Adung-Seinghku confluence on the 25th. Up to the time we crossed the last range of hills which separates the Nam Tamai (one of the head waters of the Nmai Hka, or Eastern Irrawaddy) from the last tributary of the Mali Hka, or Western Irrawaddy, we heard or saw Gibbons every day: after crossing the divide some 6,500 ft., we never saw or heard any and the natives told me they were not to be found. This pass is the lowest over the divide until many miles further south in the Triangle, and it would be interesting to find out how far north from the plains near Myitkyina these monkeys go in the valley of the Nmai; the vegetation and climate seem to be exactly the same both sides of the divide.

The Adung-Seinghku confluence (the Tamai from now on changing its name to Adung) is the end of administrative territory and from now we had to rely on native tracks and more primitive bridges. Going was pretty slow as the path was not good for laden coolies: sometimes climbing small cliffs on bamboo ladders or knotched logs, then down amongst the boulders in the river bed with occasional easier places where it crossed cultivated terraces. The houses of the natives were all hidden away in the jungle but signs of inhabitants were not wanting in small patches of cultivated land and occasional 'monkey bridges' over the river. On the fourth day the valley turned to the north and there seemed to be a definite change from typical subtropical hill jungle to forest of a more temperate type. Conifers were quite numerous in the valley bottom and there were a good many deciduous trees: even the fauna seemed to change as above this bend I saw none of the red-bellied *Callosciurus erythraeus* which were so plentiful in the Tamai and Lower Adung, and the long-nosed Squirrels (*Dremomys pernyi* and *D. macmillani*) seemed to take their place. The next day we arrived at Tahawndam, the last village in Burma, which we made our base and where we were to stay for the next three months.

The village itself consisted of three Tibetan families while there were about six Daru families scattered up and down the valley. There was also one family who claimed to be Dalons, of a different race to the Darus and to have come from over the hills to the South (? Taron valley): to my mind they appeared identical with the Darus,—looking the same, clothed the same, just as smelly and dirty and, after their first fear of us—just as friendly.

The Tibetans seemed to do themselves pretty well with a few acres of permanent cultivation round their huts and fair sized herds of yak, sheep, goats, pigs and a few fowls. They plough with yak and grow barley, maize, peas, beans, millet and buckwheat. Although they do not seem to have any fixed rotation they grow two crops a year with an occasional fallow. The leguminous crops are varied from field to field and they spread their litter from the byres on the fields before ploughing. The plough only scratches the surface of the ground, but the fields are thoroughly cultivated and the crops kept moderately clean by hand-hoeing; this latter work being done by the women and Darus. The men do the ploughing which I found not nearly such hard work as using an English balance plough. The hoe used being merly an 'L' shaped branch, sometimes iron-shod, but usually fire hardened. The Tibetan headman hunted takin, gooral, serow and barking deer with dogs, shooting them either with a matchlock or crossbow and poisoned arrows: he was a bad shot with either and must have got very close to kill. They kept no bees but collected wild honey: the early flow (mainly from rhododendrons) is poisonous and like Xenophon's Greeks with their Pontine honey I fell a victim to my greed and one day had to crawl back to camp, fainting at intervals, after a comparatively small helping.

We stayed three months at our base camp until the snow melted enough to allow us to move up the valley. During that time February-May 1931, I made the bulk of the collection of birds and during the last few weeks we were constantly noticing fresh arrivals as the migrants came up the valley. There was also a smaller local movement up the sides, the birds constantly pressing on the rear of the retreating snow.

Our second camp was three days' march, some 14 miles, up the valley at 8,000 ft. At this height there was a great difference in both fauna and flora: the trees were about half Conifers and, to the non-botanist the rest of the forest seemed to be rhododendrons with which the whole valley was ablaze. Voles appeared for the first time, and the shrews and mice were quite different from those at the base camp. Only the monotonous spring call of *Leioptila pulchella cœruleotincta* of the bird noises from down the valley followed us still. While we were here on May 21st two Tibetans crossed the Namnila and when we moved camp again on June 6th we were thinking optimistically of crossing ourselves in the near future. The next two marches brought us within 2 hours of the foot of the pass and we established our top camp at 12,000 ft. by a very pleasant meadow, carpeted at the time of our arrival with flowers and later with a very excellent strawberry. While later there was an even better raspberry. Both these latter unfortunately have refused to grow from seed!

Owing to transport difficulties we had to stay here for three months during which time we got to know the surrounding valleys pretty well. The absence of large mammals was very noticeable though there were much deer droppings in the forest. We were out every day and in all weathers but never saw anything larger than a Weasel (*Mustela subhemachalana*); Pigmy Hares (*Ochotona roylei nepalensis*) and Voles (*Anteliomys wardi*) were very common and their runs made amongst the rhododendron, juniper and cotoneaster were everywhere: as these runs were very conspicuous in places where the snow had recently melted I think they must move about under the snow to a certain extent during the winter. We were lucky enough to get two of Temminck's Horned Tragopans, and several Kusier's Blood Pheasants which with some Snow Pigeons were all the fresh meat we were able to get. The Pigeon and Blood Pheasants were pleasantly tame for one shooting for the pot but unfortunately not common: the Tragopans were neither tame nor common. There was also a large red fungus which grew on dead pine trees; this cooked with wild garlic made a very savoury dish. Our cook who, like myself, was out of tobacco used to smoke the dried leaves of an aster: my cravings were not so bad as his so I did not try it, but he assured me that it smoked well. Other local products were an aconite of which the roots were collected by the villagers from lower down used to make arrow-poison, and the bulbs of a fritillary to collect which several gangs of Chinese and Tebetans crossed the pass during our stay: from what I could make out they are a cure to every ill that the flesh is heir to whether taken internally or applied externally to wounds or broken limbs!

As the snow melted we were able to make out more and more of the surrounding country and found that the Adung has its source in a glacier at a height of about 14,000 ft. This glacier, though now in retreat with a typically convex snout, must at one time have gone down the valley almost to its junction with the Seinghku, the sides of the valley being almost entirely free from spurs and in places obviously ice worn.

Meanwhile we had sent repeated requests for coolies to the headman of Tahawndam with no result but excuses, so after some time we persuaded a gang of Chinese root-hunters to take us over the pass though they were apparently too frightened of the Tibetans to pormise to take us beyond the first village the other side. We left on September 1st with 10 half loads on a wet misty day. We found the height of the pass to be 15,000 ft. after the usual trouble with the boiling point apparatus in wind and snow: any scientist who could invent a b.p. apparatus in which the water will not all evaporate before it boils, or will boil before the spirit burns away would earn the gratitude of all travellers in mountainous country!

The path to the pass runs eastward from the foot of the glacier at the head of the valley, and after crossing the pass descends steeply over a stone screen and a snow bed to a lake lying some 1,500 ft. below. Descending steeply it turns north down a stream which rises in three glaciers to the south. The stream is about ¾ mile joins another larger stream which rises in two other glaciers to the west and north-west, one of these glaciers being split in two by a slowing down on either side of an enormous pillar of black rock. We had to ford the larger stream which though only knee-deep, ran fast and was extremely cold, after which we reached trees at 13,000 ft. and camped for the night, with smooth ice cliffs rising above our camp on both sides of the valley. The next day we travelled down the combined stream, now running east, to a large open pasture over which yak, sheep and goats grazed, and which swarmed with extremely voracious mosquitoes. The latter had all gone by our return at the end of the month. This was a short easy march through fairly open forest with large luscious raspberries growing in the more open spaces. On September 3rd we marched down the valley in a north-east direction along a good mule path crossing the Shori Chu, a tributary which joins the main river from the west, shortly before halting for the night: a path goes to Drowa Gompa up the Shori and is the direct route from the Adung valley to the Tibetan province of Zayul. The river here turns east and finally at the end of the next day's march, where it is joined by the Lokong Chu, to the south-east, eventually of course to join the Taron. On a shelf, probably the old glacier bed, some 500 ft. above the Lokong confluence and at a height of 10,350 ft. we came to the village of Jite and beyond this we were unable to go. All the able bodied men were away with the cattle at the summer grazing camps, and the old men who were left were not very friendly so in one way or another we could not get transport to go any further. One day I followed the Ridong road, which here leaves the river and runs north-east crossing 3 passes and 2 rivers between Jitte and Ridong, to the top of the first pass, the Lachong La (13,100 ft.), and with that we had to be content.

At the time of our arrival the corn had all been cut and the old men and women were carrying it, each sheaf being tied up with a wisp of straw from which the ears were first carefully cut and put in a basket. The hay too had been cut and was hanging on to the sides of the houses or festooned in the trees to dry—and yet we in England often grumble at a wet haysel! At this height there was no maize, but barley, oats, peas, turnips and, rather surprisingly, potatoes. The corn was badly rusted, as one might expect with many species of barberry growing round the fields. We had taken no arms with us for fear of offending the religious susceptibilities of the Tibetans, so that collecting was difficult. For the same reason I did not like to set traps, but the cook jumped on a mouse in a granary which I skinned *faute de mieux*, hoping much of my one Tibetan mammal. It turned out to be *Apodemus speciosus latronum* of which I had collected innumerable specimens on the other side of the pass at all heights from 2,000-12,000 ft.

Finally we left for home on September 20th, crossing the Namni La, on which there was a little fresh snow, on the 23rd with some little anxiety for our kit as we had to carry it on ponies to the foot of the pass and the coolies had to make two journies to bring it over. When the Tibetans left us at our 12,000 ft. camp, Kingdon Ward, the cook and I found ourselves rather stranded as we had only a little food left; so I left Kingdon Ward with the cook to collect his seeds, and, carrying a blanket, a hot water bottle and some food, made my way down to the base camp, sleeping under rocks etc. at night, to send some food up and to wait the return of our other servant whom we had sent back to Fort Hertz with our mail. When I arrived at the base I found that our hut had been buried under a rockslide (fortunately we had stored all our stuff in the headman's granary) so I stayed with one of the Tibetans for a week: board, lodging and service at Rs. 1-8 a day. They fed me plentifully but I found sleeping on the floor in the general heap of grown-ups, children and slaves rather trying and was glad to get away to a new camp at 10,000 ft. where Kingdon Ward joined me on October 19th. We got to our base camp once more on November 2nd and on the 20th we broke camp for the last time and reached Myitkyina on January 1st 1932 after an absence of just over 13 months.

## SYSTEMATIC LIST.

BY

N. B. KINNEAR.

**Corvus macrorhynchos macrorhynchos** Jungle Crow.

156 ♀ October 12, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.
Crows are recorded several times in Lord Cranbrook and Captain Kingdon Ward's notes but as some of these may refer to Carrion Crows I have not given them. The above specimen is an adult with the wing still in moult and has a bill measuring from base of skull 61.5 mm.

**Urocissa erythrorhyncha erythrorhyncha** Chinese Red-billed Magpie.

117 ♀ May 22, Adung Valley 28°15′ N., 97°46′ E., 8,000 ft.

**Cissa chinensis chinensis** Green Magpie.

6 ♀ January 12, Nam Tami, 4,000 ft.
Caught in a trap baited with meat [C].

**Garrulus bispecularis sinensis** Chinese Jay.

*Garrulus sinensis* Swinhoe, Proc. Zool. Soc. 1871, p. 381—Foochow.
112 ♂ May 20, Adung Valley, 28°15′ N., 97°40′ E., 8,000 ft.
Shot in fairly thick jungle [C].
This is the bird mentioned as *G. b. rufescens* in the key to *Garrulus bispecularis* in the *Fauna*. As Lord Rothschild has pointed out *G. b. rufescens* Reichenow is a synonym of *G. b. sinensis*. A new record for Burma.

**Nucifraga caryocactes yunnanensis** Yunnan Nutcracker.

*Nucifraga yunnanensis* Ingram Bull. B.O.C., xxv, p. 86 (1910)—Mts. of Yunnan.
110 ♂ juv. May, Adung Valley 28°15′ N., 97°40′ E., 7,500 ft.
Shot on the March, alarm note a harsh croak [C.].

**Parus monticolus yunnanensis** Yunnan Green-backed Tit.

*Parus monticolus yunnanensis* La Touche Bull. B.O.C., xlii, p. 51 (1921)—S.-E. Yunnan.
32 ♀ February 22, 79 ♂ April 5, 105 ♀ May 13, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.
Very common. February 28. I don't know whether tits are migratory but the last two days I have seen many more similar to No. 32 than ever before, usually in small parties between four to a dozen [C.].
March 6. Attacks the flowers of *Rhododendron tanestylum* and is perhaps responsible for some of the bitten through corallas. March 8. The last bush of *R. tanestylum* is now finished. I saw four tits in it at one time and the corallas were dropping fast. March 9. Very fond of *Rubus lineatus* and the tits are always found there in the early morning. April 11. Almost the commonest bird here is now busy collecting materials for its nest [K. W.].
In Manipur and on Mt. Victoria this race is represented by *P. m. lepcharum* of the Eastern Himalayas.

**Lophophanes ater aemodius** Himalayan Cole-Tit.

159 ♂ October 22, Adung Valley 28°15′ N., 97°45′ E., 10,000 ft.
One of a flock of about fifty [C.].
This specimen does not differ from Nepal and Sikkim examples. It was obtained by both Rippon and Forrest in Yunnan but has not been found in Burma previously.

**Lophophanes rufonuchalis beavani** Sikkim Black-Tit.

139 ♂ July 6, Adung Valley 28°20′ N., 97°45′ E., 12,000 ft.
Shot in jungle; fairly common, habits much like any other tit, but not so

active or acrobatic as some. Also seen in September in Tibet 28°25′ N., 97°55′ E. [C.].

New to the avifauna of Burma.

**Ægithaliscus bonvaloti** Chinese Black-headed Tit.

26 February 19, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

One of a flock, common [C.].

According to the *Fauna*, this Tit is found in 'Western China, Yunnan and N.-E. Shan States. There are several specimens from the last named place in the British Museum Collection'. Previous to the receipt of the above specimen no examples of this Tit existed in the Museum Collection from anywhere in Burma. Rippon, however, got a number in Yunnan, Gyi-dzin-Shan, Lichiang, etc. and Forrest also collected many examples in the same area.

**Sitta europæa nebulosa** Nuthatch.

*Sitta europæa nebulosa* La Touche Bull. B.O.C., xlii, p. 55 (1921)—Mittai, S.-E. Yunnan.

22 ♂ February 17, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

Fairly common [C.].

In the *Ibis* 1899, p. 404, La Touche described the nuthatch from Fokien as *Sitta montium* and some years later separated the bird from Miltai, S.-E. Yunnan as *S. e. nebulosa* on account of certain colour differences and larger size. Hartert considers the birds from Yunnan—Lichiang Range to Miltai—and Szechuan to belong to the last mentioned race, but all our specimens from the latter locality are *S. e. sinensis*. There is very little difference in colour between Lichiang and Fokien birds but the former were distinctly larger.

| | Wing. | Bill from skull. | | Wing. | Bill. |
|---|---|---|---|---|---|
| 6 ♂ Fokien | 72-78 | 17·5-18·5 | 13 N.-W. Yunnan | 75-84 | 17-19 |
| 3 ♀ Fokien | 71-74 | 16·5-18·5 | | | |

The hind claw is said to be larger in *S. e. nebulosa*, but I do not find that a constant character. We have several specimens of the present race in the Museum from the South Shan States collected by Rippon, Thompson, Craddock and Venning but no mention is made in the *Fauna* of this bird occurring there, while the three examples from the Kauri Kachin Hills (Rippon) are apparently recorded as *S. e. nagaensis*. Harington also notes this bird from the same area and said it was plentiful in the hills.

**Dryonastes cærulatus kaurensis** Kachin Hills Laughing Thrush.

98 ♂ April 23, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

One of a flock of about six [C.].

Rippon collected two specimens east of Bhamo and Harington two a Sinlum. A single male obtained by Forrest on his last trip does not differ from these and I think therefore that *D. c. latrifrons* Rothschild (Shweli-Salwin Divide) must be considered a synonym of *D. c. kaurensis*.

**Trochalopterum erythrocephalum forresti** Forrest's Red-headed Laughing-Thrush.

*Ianthocincla forresti* Rothschild Nov. Zool., xxviii, p. 35 (1921)—Shweli-Salwin Divide.

23 ♀ February 17, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

One of a flock. Crop full of seeds of probably some sort of ivy, also one ant and the pupae of a fly [C.].

Shot a new babbler which goes about in flocks. These birds have several calls; the normal seems to be a sort of hissing whistle on two notes. I surprised a flock in a tree and they flew one by one into the bushes. Then I sat down and one bird came to scout for me and settled on a bush just above my head and on perceiving me gave the warning signal and flew back to the others [K. W.].

I do not understand why Lord Rothschild should consider *forresti* a very distinct species and not a race of *erythrocephalum* since it is very near *T. e. woodi*, only differing in the greener back and darker underside. Forrest obtained specimens on the Shweli-Salwin divide and at Tengyuedh and Rippon collected a single example in the Kauri Kachin District in July 1901.

**Trochalopterum affine oustaleti** Oustalet's Laughing-Thrush.

*Ianthocincla affinis oustaleti* Hartert Vög. Pau. Fauna, i, p. 633—Tsekou, Yunnan.

45 ♀ March 5; 48 ♂ March 6, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.; 115 ♂ May 27, Adung Valley 28°20′ N., 97°40′ E., 9,000 ft.; 121 ♂ June 12, Adung Valley 28°20′ N., 97°40′ E., 8,000 ft.; 122 ♀ June 8, 137 ♂ July 4, Adung Valley 28°20′ N., 97°45′ E., 12,000 ft.

45 not uncommon. Usually goes about in flocks, sometimes singly. Rather silent and wary. 48 shot in low undergrowth, singing somewhat mournfully and extremely monotonously by himself. The song is only four notes constantly repeated. 115, 121. Common. 137 shot in forest, common. This bird goes right up to the limit of trees, but I have never seen it in the scrub higher up, though there is a pair in the last isolated patch of forest. Seen also during September in Tibet 28°25′ N., 97°55′ E. [C.].

45 crop contained 50 seeds of *Rubus* and over 50 of *Gaultheria* besides other seeds and remains of at least one beetle. 48 seeds of *Viburnum* (9223), 8 of *Rubus lineatus* and over 50 of *Gaultheria* (9248) [K. W.]

From *T. a. affine* this race differs in the darker head—in some examples black, in others blackish brown—less rufescent back and paler underside which is distinctly greyer. It is found in northern Yunnan and east to N.-W. Szechuan. 13 ♂ wing 102-118, 11 ♀ wing 101-109.

**Trochalopterum subunicolor griseata** The Yunnan Plain-coloured Laughing Thrush.

*Ianthocincla subunicolor griseata* Roths. Nov. Zool., xxviii, p. 33 (1921)—Shweli-Salwin Divide.

124 ♂, 125 ♀ June 13, Adung Valley 28°20′ N., 97°40′ E., 13,000 ft. Over Alpine Meadow. Iris yellow.

June 13. A new Babbler, with speckled breast, along with its mate was hopping in and out through the bushes after *Rubus* berries. From time to time they hopped up onto the top of a *Rubus* bush and getting the two in line I secured both [K. W.].

This race of the Plain-coloured Laughing Thrush was described by Lord Rothschild in 1921 from five specimens collected by Forrest on the Shweli-Salwin Divide in August 1919. It differs from the typical bird in the more olive and less rufous colour of the upper parts, especially on the rump, darker slaty head, darker throat and paler breast and abdomen, the feathers of which have larger squamations.

*Ianthocincla s. subunicolor* was described from Nepal and ranges east to the Dibang River, while the present race is known from the Adung Valley and the Tengyueh District and Shweli-Salwin Divide in Yunnan. It is a bird of high altitudes and Forrest did not find it below 7,000 ft.

Measurements of *T. s. griseata* 3 ♂ 92-95; 2 no sex 95; 1 ♀ 95.
*T. s. subunicolor* 1 ♀ 87, no sex 87-94.

**Grammatoptila striata cranbrooki** Cranbrook's Striated Laughing Thrush.

*Grammatoptila striata cranbrooki* Kinnear, Bull. B.O.C.

7 ♂ January 28, Nami Tami, 4,000 ft., 90 ♀ April 16, 99 ♂, 113 ♂ April 24, Adung Valley 28°10′ N., 97°40′ E., 6,000-8,000 ft.

No. 7 shot in bamboo forest, goes about in flocks but often seen singly. Fairly common, alarm note like a blackbird when alone [C.].

No 90. Crop full of seeds, almost entirely *Rubus lineatus* and a few of *Gantheria* [K. W.].

The Striated Laughing Thrush has not previously been recorded from Burma, though in Assam it is said to be found as far east as Margherita.

These four specimens are darker on the mantle and rump than in *G. s. austeni* and in size run larger.

| | Wing. | Bill from Skull. | Tail. |
|---|---|---|---|
| 10 ♂ Dafla Hills | 137-145 | 29-31·5 | 120-129 |
| 3 ♂ Nami Tamai & Adung Valley. | 141-152 | 31-32 | 120-135 |
| 3 ♀ Dafla Hills | 136-143 | 31 | 127-130 |
| 1 ♀ Adung Valley | 152 | 31 | 135 |

**Fulvetta vinipectus bieti** Yunnan Fulvetta.

*Alcippe* (*Proparus*) *bieti* Oustalet, Ann. Sci. Nat. (ser. 7), xii, p. 283, pl. ix (1892)—Ta-Tsien-lou.

25 ♀ February 18, 47 ♀ March 5, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

No. 25. Brought in by a small boy, who shot it with a crossbow. Crop contained small seeds. No. 47. Very common goes about in flocks chattering continuously and methodically searching low trees and undergrowth [C.].

These birds agree with a series collected by Forrest on the Lichiang Range Lat. 27°20′ N. in Yunnan.

**Leioptila pulchella cœruleotincta** Yunnan Beautiful Sibia.

*Leioptila pulchella coeruleotincta* Rothschild Nov. Zool., xxviii, p. 38 (1921) —Shweli-Salwin Divide.

8 ♀ January 28, Tamai Valley 4,000 ft., 24 ♂, February 18, 37 ♂ February 24, 58 ♂ March 11, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

No. 8. Shot sitting high up on a dead tree. One of a flock of about eight or ten.

No. 24. Goes about mainly in flocks, occasionally singly. Makes a continual chattering while searching trees and shrubs and often sits up in the top branches of a dead tree. Very common. No. 37. This bird had its breast covered with Rhododendron pollen like many at this time, making a broad yellow streak down its breast, so that it looked like a different species altogether. Small parties often sit on clusters of rhododendron flowers putting their beaks right down inside and probably do a good deal towards fertilizing the flowers. During the last week or so this bird has developed a somewhat annoying call rather like a redshank's but with three other notes of the same harshness introduced [C.].

February 24. At last I shot the five-note bird we hear every morning and it turned out to be the Yunnan Beautiful Sibia. Its throat was yellow, feathers yellow-tipped as I thought, like the first one I saw in a few days ago, which was uttering a very different cry. This yellow however was the pollen from *Rhododendron tanestylum* and I watched a bird put its head inside the flowers to suck the honey apparently. Often sits on the top-most twig of a tree surveying the landscape for a few minutes on end. It is rather the buffoon amongst birds, has as many calls as a starling and is a very cheerful bird [K. W.].

This Sibia is another of Forrest's discoveries in north-west Yunnan, where it is not uncommon. From the Beautiful Sibia *L. p. pulchella*, inhabiting the Naga, Nuri and Dafla Hills, it is distinguished by the bluish-grey colour of the underside.

**Actinodura nipalensis wardi** Ward's Bar-wing.

*Actinodura nipalensis wardi* Kinnear Bull. B.O.C., liii, p. 79 (1932)—Adung Valley.

71 ♂ March 27, 85 ♂ April 13, Adung Valley 28°10′ N., 97°40′ E.

71. Seen alone, breast covered with rhododendron pollen. I have not seen this bird down in the valley. 85 shot in low bamboo: one of a pair [C.]. In the gizzard of No. 71 I found only plant remains (probably moss). No. 85 had seeds in gizzard, mostly *Rubus lineatus*, one of *Ardesia* and a few insect remains [K. W.].

This new race of Bar-wing differs from *A. n. waldeni* Godwin-Austen (Japvo Peak, Naga Hills) in the darker colouration of the back, blacker crest and richer brown on the underside.

*A. n. waldeni* is found on Japvo and Khunho Peaks in the Naga Hills and Owenkulno Peak in Manipur and further south on Mt. Victoria is a very doubtfully distinct race *A. n. poliotis* in which the only difference seems to be that the crest is darker. To say that *A. n. poliotis* is much darker than *waldeni*, as we read in the *Fauna*, is not in accordance with the specimens in the British Museum. From Yunnan Lord Rothschild has described a further race *A. n. saturator* (Shweli-Salwin Divide) which differs from *cranbrooki* in the presence of pale edges to the feathers of the crest, mantle and underparts, the crest too is paler and the barring more pronounced.

There is in Calcutta a specimen of *Astinodura nepalensis* collected by Anderson at Ponsee which may be this race or *saturator*.

**Yuhina gularis griseotincta** Yunnan Yuhina.

*Yuhina gularis griseotincta* Rothschild, Nov. Zool., xxviii, p. 42 (1921)—Shweli-Salwin Divide.

64 ♀ March 14, Adung Valley 28°10′ N., 97°40′ E., 8,000 ft., 118 ♀ March 30, 28°10′ N., 97°40′ E., 6,000 ft.

Shot in low bamboo forest [C.]. Had *Rhododendorn grande* pollen on breast feathers [K. W.].

The name *Yuhina yangpiensis* was given by Sharpe (Bull. B.O.C., xiii, p. 12, 1902) to a single specimen collected by Colonel Rippon on the Yangpi-Talifu Road, W. Yunnan on 22 March 1902 and given to the Museum in 1903 Apparently Rippon got no further specimens, at least there are none in the Museum, but two years later in 1904 he made a collection on Mt. Victoria and secured a series of a Yuhina in March and April which are quite indistinguishable from the type of '*yangpiensis*' and moreover I can see no difference between them and the typical form from Nepal. In 1921 Lord Rothschild described *Y. g. griseotincta* which differs from *Y. g. gularis* in having the sides of the head and neck greyer, the throat and chest more vinaceous.

**Ixulus flavicollis rouxi** Chestnut-naped Ixulus.

*Ixulus rouxi* Oustalet, Bull. Mus. Paris, ii, p. 186 (1896)—Ly-Sien-Kiang, Yunnan.

15 ♂ February, Adung Valley 28°10′ N., 97°40′ E., 8,000 ft.; 86 ♂ April 14, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

Very common, goes about in flocks methodically searching bushes and trees keeping up a continual chatter all the time [C.].

I can see no difference between examples from Sinlum, Bhamo Hills, from where Harington's *I. f. harterti* was described, and specimens from Yunnan. This species has a wide range and extends from Tonkin to Yunnan, Mt. Victoria and S. Assam. Harington recorded the Chestnut-naped Ixulus as fairly common near Bhamo and Rippon also obtained it there.

**Leiothrix lutea yunnanensis** Yunnan Red-billed Leiothrix.

76 ♀ April 3, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

I have not seen this bird until two days ago, but it seems to be fairly common [C.].

Harington records this race in the Bhamo District and Anderson got six examples from near Ponsee.

**Pteruthius ænobarbes melanotis** Chestnut-headed Shrike-Babbler.

33 ♂ February 22, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

Fairly common; goes about in flocks [C.].

In the *Fauna*, *P. a. melanotis* Hodgson is given as ranging from Nepal to Manipur and *P. a. intermedius* Hume (Mooleyit) the Eastern hills of Burma from Bhamo to Tenasserim. This distribution is not however confirmed by the specimens in the British Museum. Of the former there are examples from Nepal, Sikkim, Naga Hills, Manipur, N. Chin Hills, Mt. Victoria, Kauri Kachin District (Rippon), Shweli-Salwin Divide (Forrest), Loi Pangnan, W. of Mekong, S. Shan States (Craddock) and a single ♂ from Ngoi, Toi, Tonkin (Stevens). Of *P. a. intermedius* there are specimens from Mooleyit, Thoungyeen, Tonghoo, Loi Maw, Kentung, S. Shan States (Rippon), Chapa, Fan-si-pan, Tonkin (Delacour). It appears therefore that the S. Shan States and northern Tonkin are the meeting places of the two races, but there is no sign amongst the few specimens examined of intergradation. In addition to the specimens mentioned above of *P. a. melanotis* Harington collected three birds near Bhamo.

**Myzornis pyrrhoura** Fire-tailed Myzornis.

73 ♀ March 28, Adung Valley 28°10′ N., 97°40′ E., 8,000 ft.

Goes about in flocks, chattering and methodically searching bushes and low trees, sometimes makes flights like a flycatcher. Common here but I have not seen it in the valley. Breast covered with Rhododendron pollen [C.].

In the *Fauna* the distribution of this species is given as Nepal and Sikkim, but in 1901 Oustalet recorded an example from Tsékou and more recently it has been collected by Forrest in Yunnan.

**Microscelis leucocephalus leucocephalus** Chinese Black Bulbul.

77 ♂, 78 ♂ April 3, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

One of a party of three which by their behaviour were two males in pursuit of a female. I have not noticed them before. No. 78 had the gizzard full of large seeds. Also seen in May at 8,000 ft. [C.].

Rothschild and Streseman have shown that the race of this Bulbul in China polychromatic (Nov. Zool. 1926, xxxiii, pp. 301-2 and Ornith Monatsb. 1923, pp. 83-5) and in Yunnan is found in four different phases. These two birds belong to the *sinensis* phase with glossy black locks and crests which has not been recorded from Burma before.

**Ixos macclellandi similis** The Yunnan Bulbul.

*Hemixus macclellandi similis* Rothschild.

103 ♂ May 3, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

One of a pair [C.].

This specimen has rather more chestnut-brown on the cheeks, sides of neck and breast than the majority of birds from N.-W. Yunnan, though one from Gyi-dzin-Shan, E. of Talifu is similar. Rippon obtained examples in the Kauri Kachin District at over 5,000 ft.

**Pycnonotus aurigaster xanthorrous** Anderson's Yellow-vented Bulbul.

36 February 24, Adung Valley 28°10′ N., 97°40′ E., 104 ♂ May 4, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

Fairly common [C.].

**Certhia familiaris khamensis** Tibetan Tree-Creeper.

130 ♂ June 25, Adung Valley 28°20′ N., 97°45′ E., 13,000 ft.

A bird seen in September in Tibet 28°25′ N., 97°55′ E., probably also belonged to this species [C.].

Harington observed Tree-Creepers which he took to be *C. f. nipalensis* in the Kachin hills which doubtless belonged to this race as Baker suggests, but this is the first actual record.

**Troglodytes troglodytes taiifuensis** Yunnan Wren.

56 ♂ March 9, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

Sharpe described this bird from an example collected by Rippon at Gyi-dzin-Shan, East of Talifu in Yunnan. This specimen is an exceptionally pale bird with the white spots on the wing coverts larger than usual. The Yunnan series only differs from Nepal and Sikkim examples in the rather paler underside.

In the *Fauna*, Baker includes the Shan States in the distribution of this Wren, but the only skins in the Museum collection are from Yunnan.

**Oligura castaneo-coronata** Chestnut-headed Wren.

111 ♂ May 19, 1931, Adung Valley 28°15′ N., 97°40′ E., 8,000 ft.

Shot in fairly thick forest, very common here and seen occasionally down at 6,000 ft. [C.].

In the *Fauna* the distribution of this bird is said to be Himalayas from Garhwal to the extreme East of Assam: the Khasia, Naga and Cachar Hills South of the Brahmaputra but not recorded from Manipur or further South or East. There is however in the British Museum a series collected by Rippon on Mt. Victoria, four examples from Loi Maw, S. Shan States (Rippon) and several from N.-W. Yunnan, Lichiang Range (Forrest). I can see no difference in colour between Himalayan examples and those from Burma but in size the Yunnan and S. Shan States birds run large.

| | | | |
|---|---|---|---|
| 4 ♂ Yunnan | 52-55 mm. | Sikkim 1 ♂ | 49 |
| 1 ♀ | 50 | 1 ♀ | 50 mm. |
| 4—Shan States | 53-55, | 5— | 46-52 |
| Mt. Victoria 9 | 47-50 mm. | | |

**Cinclus pallasi marila** Formosan Brown Dipper.

44 ♀ March 4, 89 ♀ April 15, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

44. Fairly common. Always seen along the river, standing on stones and diving for food. I have seen it dive off a rock about a foot above the water level, but usually from the edge of the water. Swims a little occasionally and I have once seen it dive when swimming. Very weary and shy; call like our ouzel at home.

89. Lately seen in greater numbers. I have seen it swimming in a rapid stream—about a six knot current—deliberately alight on the water and swim a considerable distance to land [C.].

There is no difference in colour in the Brown Dippers found from Assam to Formosa, though in size they vary considerably, but unfortunately we have not a good series of sexed birds from the extremes of the bird's range.

| | | | | | |
|---|---|---|---|---|---|
| 10 ♂ | Fokien and Shensi | 109-117 mm. | ♀ | Szechuan 117, probably wrongly sexed. | |
| 1 ♂ | S. Shan States | 109 mm. | | | |
| 2 ♂ | Assam | 100-102 mm. | 2 ♀ | Adung Valley and Assam | 100-102 mm. |
| 17 ♀ | Fokien, Chekiang and Shensi | 105-110 mm. | 1 ♀ | Formosa | 96 mm. |

For the large Chinese bird the name *soulie* Oustalet, type locality Ta-tsien-lu, is available and for that from Formosa *marila* of Swinhoe. Without further material it is impossible to decide whether the Assam and Formosa birds are different and for the present they must be treated as the same. In the *Ibis* 1907, p. 177, Messrs. Grant and La Touche state that the young of *soulei* can be distinguished from *marila* by the different colour of the crossbars on the underside but from the material in the Museum this does not appear to be the case.

**Rhodhophila ferrea haringtoni** Eastern Dark-grey Bush-Chat.

92 ♂ April 17, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

I have not seen this bird before [C.].

Harington found this species breeding near Bhamo and Rippon collected a young bird.

This is an unsatisfactory race and further breeding birds are wanted from South China. Hartert (Vög. Päl. *Fauna*, vol. i, p. 711) separated the Eastern bird from that of the Himalayas on account of the length of the tail which in *O. ferrea ferrea* he gives as 63-68 mm. as against 57-61.5 in *O. f. haringtoni*. Baker, however, in the *Fauna* points out an additional difference and says that *O. f. haringtoni* is distinguished 'in being whiter below at all seasons of the year, in summer the breast and abdomen are almost pure white.' After examining a large series I can see no difference in the colour of freshly moulted autumn birds from S. China and the Himalayas, but in the spring and summer when the plumage is abraded, western birds—the reverse of what Mr. Baker says—are certainly very white below but unfortunately we have practically no birds at this season of the year from S. China.

The measurements of the tails of the series of males examined is:

| | | |
|---|---|---|
| 21 | Simla, Sikkim, Manipur | 59-65 |
| 4 | Arakan and Chin Hills | 58-65 |
| 7 | Karen Hills | 56-60 |
| 10 | Yunnan | 55-61 |
| 3 | Szechuan | 53-58 |
| 11 | S. China | 56-60 |

The type of *O. f. haringtoni* was collected at Lieng-Kiang near Foochow on January 18 and not at Moupin, as stated in the *Fauna*.

**Microcichla scouleri scouleri** Little Forktail.

38 ♂ February 26, Adung Valley 28°10′ N., 98°40′ E., 6,000 ft.

Not uncommon; always seen by water running about on the stones like a wagtail. Usually on the smaller streams [C.].

There are specimens in the Museum from Nepal, Sikkim, Bhutan, Assam, the Miri and Dafla Hills and Tonkin but none from Northern Burma and the Shan States, where, according to the *Fauna*, it occurs.

**Phoenicurus frontalis** Blue-fronted Redstart.

20 ♂ February 14, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft. 49 ♂ March 6, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

Common [C.].

This species was found quite common in Yunnan by Rippon and Forrest where it apparently breeds since the latter collected a juvenile unable to fly.

After comparing Sikkim birds with those from Szechuan and Kansu I can see no difference and therefore Hartert's *P. frontalis sinae* becomes a synonym.

**Rhyacornis fuliginosa fuliginosa** Plumbeous Redstart.

29 ♂ February 20, 66 ♀ March 21, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

Shot by the River. Very common, sitting on stones hawking flies like a flycatcher and spending a certain amount of its time on trees and bushes by the river bank. When other birds have gone to roost it is still active and at this time of the day has a habit of flying almost vertically up into the air some 15 or 20 ft., then swooping down on a large spiral to its original position. Kingdon Ward has seen one dive into the water when in flight, like a kingfisher [C.].

Harington found this species breeding in the Bhamo area.

**Chaimarrornis leucocephalaus** White-capped Redstart.

10 ? February 5, Adung Valley 25°20′ N., 97°45′ E., 5,000 ft.; 146 ? July 15, Adung Valley 28°20′ N., 97°40′ E., 13,000 ft.

10. Shot by river. Sits on stones in and by the river flicking its tail and hawking flies like a flycatcher. Periodically it runs under stones and occasionally flies up into trees and bushes on the river bank but not often. Fairly common, each pair seems to keep to its own stretch of water—six to eight hundred yards. White patch in the sunlight shows up like a piece of burnished tin. 146. Fairly common; seen on any stream up to 14,000 ft.

**Grandala caelicolor florentes** The Chinese Grandala.

*Grandala caelicolor florentes* Bangs, Proc. New Eng. Zool. Club., ix, p. 77 (1926)—Tachienlu.

16 ♂, 17 ♀ February 13, Adung Valley, 6,000 ft.

Both killed at one shot fired at a large flock sitting on the topmost branches of a high tree. Occasionally a dozen or so birds would leave the flock circle round swooping up and down, then return to the main body and settle again. Crops contained fruits and seeds of *Vaccinium* [C.].

This race was separated by Bangs on account of the smaller size and brighter blue colour of the male. In regard to the colour I find that this appears to be due to structural alteration to the feather caused by wear. A February and a May specimen from Sikkim cannot be distinguished from three males from Chuan chee obtained in May and June but January and December birds from the later locality are much darker. Hodgson's type is apparently a spring bird. The difference in size holds good.

| | | | | | |
|---|---|---|---|---|---|
| 6 ♂ | *G. c. florentes* | 131-136 | 10 ♂ | *G. c. caelicolor* | 146-150 |
| 4 ♀ | ,, | 137-144 | ♀ | ,, | 135-144 |

**Calliope tschebaiewi** Tibet Ruby-Throat.

135 ♂ July 2, 140 ♀, July 6, Adung Valley 28°20/ N., 97°45/ E., 12,000 ft.

135 shot in low rhododendron scrub above tree line. Rather fond of sitting on rocks above scrub level. 140. This bird is the mate of 135—they both have the same rather metallic call. On June 25, I saw this species in rhododendron scrub at 14,500 ft. [C.].

July 12. A young bird in full fledged but not able to fly very strongly, seen at 13,000 ft. I think, judging by the behaviour of some old birds near, it was the young of *C. tschebaiewi* [C.].

According to the *Fauna,* this species breeds in N. Burma and in winter is found throughout the Burmese hills. There are no specimens in the Museum from any locality in Burma.

**Tarsiger chrysæus chrysæus** Golden Bush-Robin.

144 ♂ July 12, Adung Valley 28°20′ N., 97°45′ E., 12,000 ft.

Shot in forest; not very common [C.].

Harington records a specimen from the Bhamo District and it is not uncommon on the Yunnan Mountains.

**Ianthia cyanura rufiliata** Red-flanked Bush-Robin.

50 ♀ March 17, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.; 158 ♀ October 22, Adung Valley 28°15′ N., 97°45′ E., 10,000 ft.

50. Not very common; sits on low bushes hawking flies and hops about under them like a Robin. 158. Shot in forest, also seen at 12,000 ft. [C.]. These two birds do not differ from typical examples from Nepal and Sikkim. I cannot distinguish *I. practica* Bangs and Phillips from Loukouchai.

**Turdus atrogularis** Black-throated Thrush.

55 ♂ March 9, 63 ♂ March 13, 68 ♂ March 23, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

No. 55 not seen before, No. 68 not common but occasionally seen; always alone [C.].

No. 55 crop full of big larvae, beetles etc.; No. 63 crop contained a whole snail, beetles, larvae etc. no seeds [K. W.].

**Turdus ruficollis** Red-throated Thrush.

57 ♂ March 31, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

Shot in fairly open country. I have not noticed this bird before [C.]. Crop full of larvae, beetles etc. [K. W.].

This thrush has not been recorded from Burma before, the statement in the *Fauna* that it occurs in Northern Burma is probably based on two or three specimens in the Museum collected by Rippon in Yunnan, but wrongly labelled Kauri Kachin District.

**Oreocincla dixoni** Long-tailed Mountain-Thrush.

*Turdus dixonii* Seebohm Cat. Birds British Museum v. p. 161, 1881.

150 ♂ August 12, Adung Valley 28°20′ N., 97°45′ E., 12,000 ft.

Shot in forest; the first of this species I have noticed here, two days later I saw the same species in the scrub just above the tree line [C.].

In the *Fauna* this species is confused with *O. mollissima* and for the differences between the two see Ibis 1930, p. 579.

We have in the Museum specimens of this thrush as follows. Karen-nee vi (Ramsay), 2 Na Noi, S. Shan States, iii (Rippon), 2 S. Shan States (Thompson and Craddock), Chapa, Tonkin, xii (Delacour), 2 Lichiang Range, viii, x (Forrest), Chanting-Yangpi Road, Yunnan, viii (Rippon) Asalu, ii (Godwin Austen), Manipur (Hume), Darjeeling and Nepal (Hodgson).

**Myiophoneus temmincki eugeniae** Burmese Whistling Thrush.

157 ♂ October 21, Adung Valley 28°15′ N., 97°45′ E., 10,000 ft.

We have no specimens of this bird from N.-E. Burma, though over the border it is not uncommon in Yunnan. The correct spelling of the generic name of this bird is *Myiophoneus* and not *Myophonus* in spite of the note in the Corrigenda volume to the *Fauna*.

**Prunella collaris ripponi** Rippon's Accentor.

14 ♂ February 10, 42 ♂ March 3, 70 ♂ March 26, Adung Valley 28°10′ N., 97°40′ E., 8,000 ft.

No. 14 shot and brought in by a native. I had not noticed this bird although the native got it in the open country. Crop contained a good many small seeds including those of grasses. No. 42 brought in by a small boy. Not uncommon in open country and among low bushes. No. 70 one of a flock of about a dozen working about in open country and periodically flying all together for a short distance and then scattering and searching the dead grass and bracken, every now and again getting on top of a boulder to have a look round [C.].

**Prunella strophiata multistriata** David's Accentor.

46 ♂ May 5, 59 ♂ May 12, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

Not uncommon, habits like a robin hopping about under and amongst low bushes. A chattering alarm note [C.].

Originally described from Moupin, this accentor is not uncommon in N.-W. Yunnan, but has not before been noted so far west previously.

**Prunella immaculata** Maroon-backed Accentor.

12 ♂ February 9, 344 ♀ February 22, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

Goes about in small parties in fairly open country searching under leaves and in low bushes; fairly common [C.].

This accentor ranges from Nepal eastward along the Himalaya to Szechuan and south to Yunnan—the Mekong-Salween Divide etc. It has not been previously recorded from Burma.

**Hemichelidon sibirica rothschildi** Yunnan Sooty Flycatcher.

148 ♂ July 22, Adung Valley 28°20′ N., 97°45′ E., 12,000 ft.

Shot in the forest, not uncommon [C.].

This race was described from birds collected by Forrest in the Tengyueh District and the Lichiang Range. The specimen from the Shan States—presumably the bird collected by Rippon East of Stedman, S. Shan States but no details are given—mentioned by Baker in the *Fauna* as belonging to this race appears to me to be indistinguishable from Himalayan examples. Bailey however shot a male at Sangachu Dzong, S.-E. Tibet in June.

**Siphia strophiata strophiata** Orange-gorgeted Flycatcher.

97 ♂ April 22, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

Not seen before during this month. Flight and habits like a Robin [C.].

Forrest and Rippon collected numerous specimens in Yunnan and Anderson obtained a male at Ponsee while Harington shot a single example in the Bhamo District.

**Muscicapula sapphira** Sapphire-headed Flycatcher.

97 ♂ April 22, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

Shot in fairly open country, not seen before [C.].

Anderson got a specimen in April at Ponsee and Forrest several examples in the Salwin Valley latitude 25°20′ N. Three Burmese birds in the Museum do not differ from typical Nepal and Sikkim skins though they run larger.

| | | |
|---|---|---|
| 7 ♂ | Sikkim and Naga Hills | 59-62.5 mm. |
| 3 ♂ | Salwin and Adung Valley and S. Shan States. | 63-64 mm. |

**Eumyias thalassina thalassina** Verditer Flycatcher.

81 ♂ April 8, 88 ♂ April 13, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

Not seen before April 8, but fairly common afterwards [C.].

True *Eumyias thalassina thalassina* (olim *Stoparola melanops*) is found from Nepal and Sikkim through Assam, Burma, part of Assam down to S. Annam, and has no black line at the base of the bill, whereas in 90 per cent. of the birds from the Malay Peninsula and Borneo it is present. In addition these southern birds are smaller.

| | | Wing. |
|---|---|---|
| 8 ♂ | Malay Peninsula | 71-77 mm. |
| 2 ♂ | Borneo | 75-77 mm. |
| 4 ♂ | S. Annam | 85-88 mm. |
| 5 ♂ | S. Shan States and Karanee | 86-89 mm. |
| 7 ♂ | Sikkim | 81-87 mm. |

**Culicicapa ceylonensis ceylonensis** Grey-headed Flycatcher.

102 ♀ May 3, 1931 Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

Fairly common, but not seen until about ten days ago [C.].

Harington found this flycatcher common at Bhamo.

**Chelidorhynx hypoxantha** Yellow-bellied Flycatcher.

127 ? June 21, 132 ♂ June 27, Adung Valley 28°20′ N., 97°45′ E., 12,000 ft. Also seen in September in Tibet 28°25′ N., 97°55′ E. [C.].

Breeds commonly in the Bhamo district according to Harington and Forrest found it common in Yunnan.

**Pericrocotus brevirostris affinis** Assam Short-billed Minivet.

109 ♂ May 16, Adung Valley 20°15′ N., 97°40′ E., 7,500 ft.

Killed by a coolie with a stone [C.] 10 April, saw a flock of six scarlet minivets today [K. W.].

The single male minivet listed above, two males collected by Rippon in the Kauri Kachin District and one by Anderson on the Taping R., Kakhyen Hills agree with birds from Assam and Sikkim. Unfortunately we have no good skins of females from the first two localities to compare with topotypical *P. b. affinus*, but they are sufficient to show that they are not *P. b. styani* Baker (Szechuan), if indeed that race can be distinguished from *P. b. ethelogus* Thayer and Bangs (Hupeh). Four females from Mt. Victoria are very rich yellow below and grey on the back, wanting the greenish tinge in Assam birds. A Manipur female is much the same and so too is one from Taungyi, S. Shan States while another from 'S. Shan States' (Rippon) does not differ from the Assam examples. A single female from Fort Stedman (Rippon) is paler on the back than typical *affinis* but with the same greenish yellow rump to the female of Baker's *P. b. ripponi*, the supposed male of which was collected by Rippon at the same time and place. This 'male' is not sexed and there is no evidence to show that it is a male—indeed I should say it was a female abnormally coloured. It differs from the normal female in the darker back and on the yellow replaced by reddish orange. From the normal male it differs in not having a black throat, no black on the upper surface and the scarlet replaced by reddish orange. Furthermore it has a reddish orange band on the forehead which is not found in any minivet. There is a very similar bird, rather more orange, also collected by Rippon, from the Kauri Kachin District in July 1901. These birds are indeed very similar to some of the females of *P. b. annamensis* Robinson and Kloss from Dalat, S. Annam.

**Pericrocotus solaris solaris** Yellow-throated Minivet.

9 ♂ January 31, Nam Tamai Valley N.-E. Burma, 4,000 ft.

Spiders and beetles in crop [C.].

**Dicrurus leucophæus hopwoodi** Assam Grey Drongo.

95 ♂ April 19, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

Habits like any drongo, sits on the bare branch of a high tree hawking flies etc. Very wary, I have been trying to get one for the last two months. Not uncommon; there seems to be more about this last month [C.].

**Tribura thoracica thoracica** Spotted Bush-Warbler.

134 ♂ July 3, Adung Valley 28°20′ N., 97°45′ E., 12,000 ft.

Shot in low scrub jungle above tree line, common [C.].

Godwin-Austen obtained this species in Sylhet and apparently it has not been found further east within Indian limits, though in Yunnan Forrest collected specimens on the Mekong-Salwin Divide and the Lichiang Range.

**Phylloscopus pulcher pulcher** Nepal Orange-barred Willow-Warbler.

136 ♀ July 3, 1931, Adung Valley 28°20′ N., 97°45′ E., 12,000 ft.

Shot in jungle, very common [C.].

**Phylloscopus magnirostris** Large-billed Willow-Warbler.

120 ♂ June 4, Adung Valley 28°20′ N., 97°40′ E., 9,000 ft.

Common [C.].

**Phylloscopus inornatus inornatus** Crowned Willow-Warbler.

84 ♂ April 10, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.; 149 ♀ August 10, Adung Valley 28°20′ N., 97°45′ E., 12,000 ft.

Anderson collected specimens at Bhamo and Ponsee.

**Abroscopus schisticeps ripponi** Sharp's Flycatcher Warbler.

54 ♀ March 8, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

Shot with a crossbow, common, goes about in flocks methodically searching bushes, sometimes going up trees, particularly those covered with creepers, then flying down together one after the other like a lot of falling leaves, make a continual chattering [C.].

Rippon and Forrest found this bird common in N.-W. Yunnan.

**Perissospiza icteroides affinis** Allied Grosbeak.

133 ♀ juv. June 28, Adung Valley 28°20′ N., 97°45′ E., 12,000 ft.

One of a pair; the other presumably the male had a very attractive golden yellow breast—both made rather a pleasant bell-like call [C.].

July 13. Watched one hopping about on the grass under bushes, picking up seeds. It was quite close to me and did not appear afraid [K. W.].

Not recorded from Burma before, though Forrest and Rock found it not uncommon on the Lichiang Range and Bailey obtained a male on June 19, 1911, at La Gyap 13,500 ft., E.-E. Tibet latitude 28°50′ N., longitude 98° E.

**Perissospiza carnipes carnipes** White-winged Grosbeak.

151 ♀, 151a ♀ juv., August 14, Adung Valley 28°20′ N., 97°45′ E., 12,000 ft.

Eats the blue *Gaultheria* berries [K. W.]

According to the *Fauna* this Grosbeak is not known further east than 'the hills north of the Brahmaputra in Assam'. Both Rippon, Forrest and Rock met with it in N.-W. Yunnan.

**Pyrrhula erythaca** Beavan's Bullfinch.

123 ♂ June 13, 138 ♂, July 8, Adung Valley 28°20′ N., 97°45′ E., 12,000 ft.

Shot in Abies forest; June 23, four seen [K. W.]. Not uncommon [C.].

It is very doubtful whether *P. e. altera* Rippon—Yunnan—can be kept distinct from *P. erythaca erythaca*—Sikkim—since the only difference in colour appears to be that in Sikkim males the red on the breast is suffused with yellow, while in birds from Yunnan the yellowish tinge is wanting. In size Yunnan birds run rather larger 8 ♂ 82-87 mm. as against 7 ♂ from Sikkim 80-84.5 mm. We have no females of the typical form and I have not been able to hear of one in any collection. According to the *Fauna* Bullfinches of this type have been seen in the N. Shan States.

**Pyrrhula nepalensis ricketti** Rickett's Bullfinch.

*Pyrrhula ricketti* La Touche Bull. B.O.C., xvi, p. 21 (1905)—Mts. of N.-W. Fokien.

93 ♀, 94 ♂, April 18, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

A pair not seen before [C.].

These two specimens agree with a series from Fokien. Forrest obtained examples in N.-W. Yunnan. This race is distinguished from *P. n. victoriae* by the darker colour of the back and more scaly appearance of the feathers of the head. It is new to Burma.

**Carpodacus erythrinus roseatus** Common Indian Rose-Finch.

106 ♂ May 13, Adung Valley 28°10′ N., 97°40′ E., 7,500 ft.

Not uncommon, shot with a crossbow [C.].

**Spinus tibetanus** Tibetan Siskin.

51 ♂, 52?, 53 ♀, March 8, Adung Valley 28°20′ N., 97°40′ E., 6,600 ft.

Shot out of a flock of about forty or fifty wheeling about not very high up. I killed a fourth—a female—but it was too badly shot to preserve. Crops full of small seeds and quartz grains. I have not noticed this bird before [C.].

The Tibetan Siskin, originally described from the borders of Sikkim and Tibet, was for long only known from that area. In 1926 Lord Rothschild recorded in the Novitates Zoological, xxxiii, p. 332, a male from the Lichiang Range, Yunnan, collected by Forrest and in 1931 Dr. Rock obtained a pair on Gyi-na-loko in the autumn.

In the *Fauna* it is stated that Whymper's and Ward's collectors procured a nest in Ladak, but the species is not included in Colonel Ward's list of birds of Kashmir and I think there must be some mistake. Moreover Ladak has been carefully worked by a number of Ornithologists within recent years and no one seems to have met with it. As pine forests do not exist in Ladak it is most unlikely that a bird like a Siskin would be found there.

**Passer rutilans intensior** Yunnan Cinnamon Sparrow.

60 ♀, 61 ♂, 62 ♂, March 13, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

Shot just before sundown as the flock was going to roost in a high leafy tree. They were behaving much the same and making a similar noise as sparrows going to roost at home. Occasionally the whole flock—about 15-20 birds—would leave the tree, circle round once or twice and then go back and sit chattering and moving about on the tree once more. I have not noticed this bird before [C.].

**Fringillauda nemoricola nemoricola** Hodgson's Mountain Finch.

30 ♀, 31 ♂, February, 43 ♂ March 3, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

No. 30. One of a flock of about twenty feeding on cultivated land lying fallow. While feeding the whole flock would rise together, wheel round in the air once or twice and again go down on the ground or settle in a tree for a time. This and No. 31 were both got with one shot but unfortunately No. 43 only had a wing broken. It fluttered away along the ground with the remainder of the flock flying round and swooping down on it just as rooks and jackdaws will do when one of their number is wounded. I have not seen this bird before. No. 43 brought in by a native. Not uncommon in open country and cultivated land; always seen in flocks. Crop full of seeds [C.].

Not recorded from Burma before, though it occurs in Yunnan, on the Lichiang Range (Forrest).

**Emberiza pusilla** Little Bunting.

19 ♂ February 13, 40 ♀ March 1, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

No. 19 brought in by a native, crop full of seed; No. 40 fairly common on cultivated land and open country [C.].

Stanford obtained two females at Hopin in the plains of the Myitkyina District in 1932.

**Motacilla alba leucopsis** White-faced Wagtail.

67 ♂ March 23, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

Two seen together. I have seen no others nor noticed this wagtail before [C.]. Harington mentions this bird as occurring in the Bhamo District.

**Motacilla cinerea caspica** Eastern Grey Wagtail.

96 ♂ April 22, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

Not seen before [C.].

**Motacilla citreola calcarata** Hodgson's Yellow-headed Wagtail.

100 ♂ May 1, 101 ♀ May 2, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

No. 100. One of a flock shot in open. First seen about a week ago. N. 101. One of a pair, the other similar to No. 100 [C.].

**Anthus hodgsoni** Indian Tree Pipit.

13 ♂ February 9, 27, 28 ♂ February 19, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

Very common on the flat open bracken covered valley bottom. Crop full of seeds [C.].

**Anthus roseatus** Hodgson's Pipit.

128 ♂ June 23, Adung Valley 28°20′ N., 97°45′ E., 12,000 ft.; 147 [♀] July 21, Adung Valley 28°20′ N., 97°40′ E., 12,000 ft.

Shot in open meadow above tree line, seems fairly common [C.].

According to the *Fauna* this bird is said to occur in the Northern Shan States but there are no specimens in the Museum from anywhere in Burma.

**Æthopyga ignicauda exultans** Yunnan Fire-tailed Sunbird.

129 ♂ June 25, Adung Valley 28°20′ N., 97°45′ E., 13,000 ft.

Very common amongst the scrub rhododendron, juniper etc. above the tree limit. I have not actually seen it in the forest yet [C.].

This race of the Fire-tailed Sunbird was included in the *Fauna*, although it had not actually been recorded from within the limits dealt with. There is however a female in the Museum collection obtained by Rippon in the Kauri Kachin District. It is rather dark in colour, as are many of that collector's specimens, owing to his methods of drying! Salvadori recorded *ignicauda* from Bhamo.

Five birds from Yunnan in the British Museum were separated from the typical race by Stuart Baker as *A. i. exultans* on account of the deeper crimson of the upper side, deeper yellow below, greater extent of red on the breast and larger bills. A male from Kumaon and two from Nepal are certainly paler than the Yunnan birds, but in over eighteen from Sikkim and Assam a few are the same as the Nepal birds while the majority are darker and resemble very closely the Yunnan specimens, indeed, if these last were better prepared I doubt much whether they could be distinguished from them. In the yellow colour of the underside I can see no difference and in three out of the five Yunnan specimens the red on the breast is in no way different to Sikkim examples, but in the remaining two, the type and another, the red on the breast is brighter and of greater extent. The bills according to Baker measure *A. i. ignicauda* 17-19 mm, *A. i. exultans* 19-21 mm., but I find there is no difference my measurements being 17.5-19.5 mm. and 18-19.5 mm. respectively.

**Æthopyga dabryii** Dabry's Sunbird.

72 ♂ March 27, 91 ♂ April 16, Adung Valley 28°10′ N., 97°40′ E.

Not so common as *Æ. nepalensis nepalensis* [C.].

**Æthopyga nipalensis nipalensis** Nepal Yellow-backed Sunbird.

11 ♂ February 6, 18 ♀ February 13, 35 ♂ February 24, 69 ♂ March 23, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

Very common. No. 69 shot with a crossbow. These little birds are very common and equally confiding, so are a ready prey for small boys with a crossbow [C.].

March 22. Saw Sunbird visiting *Rhododendron stenautus* [K. W.].

**Hypopicus hyperythrus sikkimensis** Eastern Rufous-bellied Woodpecker.

108 ♂ May 16, 116 ♀ May 29, 119 [♀] June 2, Adung Valley 28°15′ N., 97°40′ E., 7,500-8,000 ft.; 155 ♂ October 11, Adung Valley 28°15′ N., 97°40′ E., 6,000 ft.

In the *Fauna* this Woodpecker is not recorded further south in Burma than the Kachin Hills but there are in the British Museum specimens from Maymyo (Harington), Kalaw (Craddock, Thompson, Oates and Venning), Tonghoo (Hargett collection) and S.-W. Yunnan (Wingate). In addition it has been recorded from Mt. Victoria by Wood, the Chin Hills by Hopwood and Mackenzie and various localities in the S. Shan States by Bingham and Cook.

**Dryobates cathpharius tenebrosus** Yunnan Red-breasted Pied Woodpecker.

*Dryobates cathpharius tenebrosus* Rothschild Nov. Zool. 1926, xxxiii, p. 240—Shweli-Salwin Divide.

21 ♀ February 16, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

Habits are much more like a Tree Creeper, flying from dead tree to dead tree and searching each one methodically. The call is loud for the size of the bird and is a rather monotonous chip, uttered at intervals when searching a tree and rather more quickly when flying. Not uncommon, I have seen three or four during the last ten days [C.].

This single specimen belongs to the race described by Lord Rothschild from Yunnan which 'differs from *D. cathpharius* in the less yellowish, more greyish underside, which is much more heavily spotted with black'. From *D. c. pernayi* Verreaux (Rev. et Mag. Zool. 1867, p. 271) from Kansu this race is distinguished by the smaller size and lesser amount of black on the breast and malar streaks, while compared with *D. c. pyrrhothorax* Hume (Manipur and Naga Hills) it has a greater amount of black on the underside and also is larger. In addition to the female listed above we have two males collected by Forrest on his last expedition in Yunnan, a male from the Yangtze big Bend (Rippon) and others from Na Noi, Loi Maw and the hills east of Fort Stedman in the S. Shan States (Craddock and Rippon).

Measurements: —

| | | Wing. | Bill from base of skull. | | Wing. | Bill. |
|---|---|---|---|---|---|---|
| *D. c. cathpharius* | 4 ♂ | 100-102 | 18.5-20 | 4 ♀ | 97-102 | 17.5-20 |
| *D. c. pyrrhothorax* | 4 ♂ | 97-99 | 18.5-20 | 1 ♀ | 97 | 18.5 |
| *D. c. tenebrosus* | 5 ♂ | 97.5-104 | 19-21.5 | 4 ♀ | 99-104 | 18.5-20 |
| *D. c. pernyi* | | 111-112 | 20.5 | — | — | — |

**Dryobates darjellensis** Darjeeling Pied Woodpecker.

114 ♀ May 27, Adung Valley 28°15′ N., 97°40′ E., 8,000 ft.

Shot in jungle, not uncommon [C.].

This Woodpecker in the *Fauna* is stated to be found in Burma—the Chin and Kachin Hills, and Shan States. It is however not represented in the Museum from the Shan States or Kachin Hills and I cannot find any record of its occurrence there, though we have specimens from Tonghoo.

**Sasia ochracea ochracea** The Indian Rufous Piculet.

2 ? December 2, 1930, Kadrangyang, 70 miles N. of Myitkyina, 2,000 ft.

Habits like any woodpecker tapping slowly and then tearing off slivers with its beak. Mainly seen on dead bamboo and tall grasses—common [C.].

This single example belongs to the typical race, which is found from Nepal to Suddya and south to the Kauri Kachin District, whence Rippon obtained an example. Harington records it nesting in the Bhamo District. *S. o. querulivox* Baker, Assam S. of the Brahmapootra, Naga Hills, Manipur, Lower Chindwin and S. Shan States, is intermediate between the typical race and *S. o. reichenowi* Hesse a pale bird found in Tenasserim—as far south as the Pakschan estuary—Tounghoo and S. Annam.

Some examples of *S. o. querulivox* are very pale, indeed four skins in the museum from the Khasia Hills are barely separable from Tenasserim specimens.

**Cuculus poliocephalus poliocephalus** Small Cuckoo.

107 ♂ May 14, Adung Valley 28°10′ N., 97°40′ E., 7,500 ft.

I heard this bird for some weeks, but have not been able to see it before. It has a particularly maddening and monotonous call, rather like the expostulations of a very young hen with a treble voice, which has just escaped being run over by a car, repeated at short intervals for hours! [C.].

Rippon obtained a specimen in the Kauri Kachin District in July and Harington lists it as occurring in the Bhamo District. Probably this cuckoo breeds in the N.-W. Yunnan mountains as Forrest collected examples between May and August on the Lichiang Range and the Tenguyeh Valley.

**Upupa epops longirostris** Burmese Hoopoe.

87? April, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.

Only seen during the last few days and then only twice [C.].

**Pyrotrogon erythrocephalus erythrocephalus** Red-headed Trogon.

5 ♂ January 9, Nam Tamai 4,000 ft.

Fairly common [C.].

**Collocalia brevirostris pellos** Szechewan Swiftlet.

*Collocalia inopina pellos* Thayer and Bangs, Mem. Mus. Comp. Zool. Harvard., xl, p. 158 (1912)—Waschan, Szechuan.

65? March 15, Adung Valley 28°10′ N., 97°40′ E., 8,000 ft.

February 25. Swifts seen tonight for the first time; 28 February seen again just before sundown; 14 March. Seen flying very high tonight. No. 65;

This is the bird referred to above as 'swift'—a great number seen today—15 March—all flying low. Also in Tibet 28°25′ N., 97°55′ E., September.

We have in the Museum only four specimens of this bird—in addition to the above specimen in the Museum as follows: Tonkin (Stevens) recorded by me as *C. inominator* (!); adult and juvenile Omi-hsien, S. Szechuan (M. P. Anderson) and an adult (labelled juvenile) from the Mekong-Salwin Divide (Forrest), which was recorded as *C. f. brevirostris* by Lord Rothschild. To the west this race of swiftlet is replaced by *C. b. brevirostris*, which ranges from Eastern Assam and Manipur to Dalhousie, and differs in its smaller size.

**Glaucidium cuculoides rufescens** Burmese Barred Owlet.

160 ? November 29, 1931, Nam Tamai.

Trapped and brought in by natives [C.].

**Ducula badia griseicapilla** Grey-headed Imperial Pigeon.

Ducula badia griseicapilla.

3 ♂ December 11, 1930, Kachin Hills, 150 miles N. of Myitkyina.

Recorded by Harington from Bhamo District. Apparently this pigeon does not extend into Northern Yunnan as neither Forrest nor Rippon collected specimens, though Wingate obtained a single male at S.-W. Yunnan.

**Columba leuconota gradaria** Hartert, Eastern Snow Pigeon.

131 ♀ June 25, Adung Valley 28°20′ N., 97°45′ E., 14,000 ft.; 141-2 ♀ July 8, Adung Valley 97°40′ E., 13,000 ft.

No. 131 one of a pair, the other of which flew away and settled on a stone slide, where its colouration, which was rather conspicuous on the grass, merged perfectly with the background.

July 8. Climbed to about 15,000 ft. and saw several pigeons similar to No. 131 and by a really fine effort succeeded in killing three out of a flock of six at one shot. Both this flock and two others, which I saw were, feeding on open screes between 13 and 15,000 ft. July 9. Another flock of pigeons, similar to those seen yesterday, seen at about 14,000 ft. These pigeons are almost always seen on stony screes feeding, though occasionally they are to be seen on the grass when they are very conspicuous. In flight their white bodies show up in marked contrast to their dark wings [C.]. No. 131. Crop full of small bulbils of the pink *Polygonum* and a few seeds of *Morina* [K. W.].

This pigeon has not previously been recorded from Burma and Forrest sent no specimens from Yunnan, though further north it occurs in that country on the Yangtse, where Dr. Rock obtained examples, which according to Riley (P.U.S.N.M. 80, p. 15, 1931) are somewhat intermediate in colour between *C. l. leuconota* and *C. l. gradaria* Hartert from Szechuan.

**Gennæus horsfieldi horsfieldi** Black-breasted Kalij.

4 ♂ December 23, 1930, Hkampti Plains, Upper Burma, 1,500 ft.

This and a companion were seen together at close range and both seemed identical. They walked about making a low clucking noise.

Rippon and others obtained this pheasant in the Bhamo District where it appears to be not uncommon.

**Lophophorus sclateri** Sclater's Monal.

153, 154 ♀ juv. August 19, Adung Valley 28°20′ N., 97°45′ E., 13,000 ft.

August 17, Monal heard calling at 13,000 ft. amongst scrub and cliffs above the tree limit. I could not see them because of the mist and rain, though they sounded quite near. August 19, high up above the tree line I saw a flock of monal and after a difficult stalk managed to get within range and shot two. One bird in the flock (the cock ?) was much bigger than the two I shot and had the blue round the eye more pronounced, but otherwise appeared very similar. These birds seem to keep very much to the same locality: during the two months we have been here I have found two places where these birds live and never have been there without either seeing or hearing them. They are very cunning, one of the flock always seems to be on guard on some ridge or prominent mound and gives away their position by uttering the rather harsh alarm call (rather like a mixture between that of a peacock and a guinea fowl), otherwise they would probably escape unobserved as their colouration harmonizes admirably with their haunts among the dwarf rhododendron, juniper, cotoneaster, grass etc. Nos. 153-154 contained *Polygonum* seeds and heads of some thistle or hard-headed flower in their crops [C.].

July 10. Saw a pair of Monal and then saw and heard six or eight higher up on the grey scree. Two sentinels stood on rocks uttering their shrill, rather plaintive alarm call, a single cry repeated again and again while the others strutted up the scree together.

Baker does not give this Monal as occurring in Burma, though in the donation list of the Society, vol. xxiii, p. 592, there is a record that Mr. F. C. Lowis presented three from the Burmo-Chinese frontier. These came from the Htawgaw Hills, between the Kachin Hills and Yunnan, in the cold weather of 1914 and Capt. Kingdon Ward has recorded it from Imam Bum in the same Hills (*Journal* 1921, xxvii, p. 756). Later in 1925 the late Capt. West shot two males near Myitkyina in October which are now in the National Collection. Capt. Kingdon Ward, on his 1924 plant collecting expedition down the Tsangpo, obtained a male in juvenile plumage and an adult female at the Po-Tsango and Tsangpo confluence at 9,000 ft. on February 14. Lord Rothschild records (Nov. Zool. 1926, p. 211) that Forrest obtained a young male which he says 'is so far unique' but does not give any description of it and I therefore add one of Capt. Kingdon Ward's bird. Differs from the adult female in the darker colour of the mantle, the paler, more white, colour of the lower back, rump and upper tail coverts and in the greater amount of cinamon on the tail feathers, which colour is entirely absent from the adult from the Tsangpo, but present in slight frecklings in a bird from the Mishmi country and figured in P.Z.S. 1879, pl. li. The upper side of the young male is narrowly barred with faint cinamon bands instead of frecklings. On the breast and neck the black feathers of the adult are beginning to appear and a few metallic feathers to show on the head.

**Tragopan temmincki** Temminck's Tragopan.

82 ♂ June 7, Adung Valley 28°10′ N., 97°40′ E., 7,000 ft.

Bill black; feet flesh; iris slate; round eye, throat and harns bright cobalt blue.

Brought in by a native trapped in the jungle [C.]

According to Oates (*J.B.N.H.S.*, xix, p. 260) Lt. C. M. Macmillan shot a male of this Tragopan in 1903 at Sadon, due East of Myitkyina at an elevation of about 9,000 ft., and in March 1904 Mr. W. Scott shot two examples on the Pansing Pass near the same place. In the cold weather of 1914 Mr. F. C. Lowis obtained a male near Htawgaw, while we have in the British Museum a pair procured by Major Burd in the Myitkyina District in October 1925, and another got by Capt. West near Hipmaw in October 1925 and it appears therefore that this Tragopan is not uncommon in N.-E. Burma. In addition to the specimens obtained by Co. F. M. Bailey in the Mishmi country and S. Tibet (Op. cit., vol. xxiv, p. 76) it should be mentioned that Capt. Kingdon Ward collected a young male on December 16, 1924, at the confluence of the Po-Tsangpo and Tsangpo in S.-E. Tibet.

All the western examples of this Tragopan I have examined are rather darker below and of a less brick red than Chinese birds and in size tend to run larger, wing 243, 254, 260, 263 mm. as against 230-253 in fourteen Yunnan and Szechuan birds.

*Tragopan temmincki* was first made known to science by Dr. J. E. Gray in the *Illustrations of Indian Zoology*, vol. i, plate 50 (December 2, 1831) and the bird from which the drawing was made was presented along with a second male to the British Museum by J. R. Reeves. Gould (*Birds of Asia*, vol. vii, pl. 47) tells us that Reeves first saw this species in the aviary of a Mr. Beal in Macao and 'did not rest until he had sent specimens to the National Collection'. On May 13, 1834 Dr. G. Bennett exhibited before a meeting of the Zoological Society a drawing of one of Mr. Beal's birds and stated that they came from 'the province of Yunnan bordering on Tibet', adding that Mr. Beal had not been able to obtain any female specimens.

**Ithaginis cruentus kuseri** Yunnan Blood-Pheasant.

74 ♀ March 31, Adung Valley 28°10′ N., 97°40′ E., 8,000 ft.; 126 ♂ April 20, 142, 145 ♂, ♀ July 10, Adung Valley 28°45′ N., 97°45′ E., 12,000 ft.

No. 74 shot sitting on a pile of logs. No. 142 shot in forest, alarm call like a hen common pheasant. One of a pair, the other ran about mewing for some time, but I could not see it. July 10. I saw two pairs of Blood pheasants, each pair walking about together with a well grown family. The young were, I should say, at least six weeks old and were in the forest at about 13,000 ft. August 19. Today came across a family party of Blood pheasants. Shot the cock and a young hen, the latter the size of a French partridge. The party consisted of six or seven and I had to follow them through the forest before I could get a second. All the time they kept 30-40 yards away and continually uttered their alarm call, though occasionally they would stop to pick up food [C.].

July 27. Alpine Valley. In the forest I saw a pair of Blood pheasants. The female has a crest and strutted about, with tail outspread bobbing her head abruptly to pick up food as she walked, then throwing it up suddenly and all the time she uttered a single rather querulous cry. The male has the same upright way of pecking at the ground and looking up quickly. His tail however was not spread. October 4. In forest below ridge ( area 19,000 ft.) I saw a whole party of Blood pheasants—at least eight—they were certainly two cocks. The cock gives a shrill cry of alarm, runs a short distance, then stops, the rest of the covey also. As often as not they stand on an eminence and look at you from some twenty to thirty yards away. They seem to be bewildered and run hither and thither, but never go far. The cock struts and runs with his tail outspread. On October 30 a large family of Blood pheasants visited the camp and five were shot, but the remainder took very little notice and were scarcely alarmed, continuing to squawk and run this way and that [K. W.].

In the *Fauna*, this Blood Pheasant is said 'to inhabit Yunnan on the Shweli-Salwin Divide; extending west to Mishmi and Abor Hills and north and east of the Dihong and Brahmapootra rivers.' We have in the British Museum the following specimens: ♂ Tsekou, Yunnan (P. R. Soulce); Tenguyeh, Yunnan (E. B. Howell); ♀ (2 ♂ also obtained) near Htawgaw Hills, between Kachin Hills and Yunnan cold weather 1914 (F. C. Lowis) 4 ♂, 1 ♀ Hipmau, Myitkyina District October 1925 (West); 2 ♂, 1 ♀ Seinghku Valley 10,000 ft., 28°8′ N., 97°24′ E., May, June and October, 1926 (F. Kingdon Ward); 6 ♂, ♀, Tsu R., Mishmi Hills and Sumdo, S. Tibet (F. M. Bailey).

Two males of *I. c. clarkei* collected by Forrest on the Lichiang Range approach *I. c. kuseri* and have the throat and breast washed buff, intermingled with numerous red feathers. I have followed Lord Rothschild in considering all the Blood Pheasants as races of *I. cruentus* Hardwick from Nepal.

**Tringa hypoleucos** Common Sandpiper.

1 ? November 30, 1930, Tiang Zup 50 miles N. of Myitkyina.
Seen on several occasions.

**Phalacrocorax carbo sinensis** Chinese Cormorant.

80 ♀ April 7, Adung Valley 28°10′ N., 97°41′ E., 6,000 ft.
Shot sitting on a log in the river and seen fairly often during the last three weeks, but not before. Unexpectedly good eating! Several more also seen [C.].

**Anas crecca crecca** Common Teal.

39 ♀ February 27, Adung Valley 28°10′ N., 97°40′ E., 6,000 ft.
Shot at dusk in a small muddy backwater off the Mai river. I have not seen this duck before [C.].

# THE LIFE-HISTORY OF THE SPIDER (*MYRMARACHNE PLATALEOIDES*) (CAMBR).

## *A mimic of the Indian Red Ant.*

BY

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(*With one plate*).

The Spider *Myrmarachne plataleoides* is a common mimic of the Red Ant, *Oecophylla smaragdina* which may be seen almost anywhere in this country. The mimicry is so perfect that quite often it requires the second glance of even an experienced collector to distinguish one of these spiders from the ants amongst whom they are often seen moving about. Mimicry of ants by spiders is supposed to bestow on them certain advantages. In some cases the mimicry is suggested to be aggressive; under the false garb of an ant, the spider is supposed to be enabled to approach the ants without raising their suspicions, and thus feed on them with impunity. This, however, need not be considered here since this spider does not appear to feed on its models.

In certain others, of which the present is an instance, the mimicry is supposed to be protective; the ants being ferocious are generally left alone by insectivorous animals and the spiders by imitating them and living near them might share their immunity.

The Red Ants are certainly ferocious, but the protective value of a spider imitating this ant is questioned on many grounds. It is pointed out that the *Oecophylla* is not so immune from the attacks of insectivorous animals as is generally believed to be; there are certain birds and other animals which do feed on them. C. W. Mason in his "*Food of Birds in India*" speaks about ants:—"The ants like the grasshoppers are exceedingly abundant insects and form a very large proportion of the insect food of birds in India. They are perhaps the favourite food of the Woodpeckers, Wrynecks, Rollers and some of the pheasants. Most birds that eat insects of any kind will almost certainly be found to take ants of one species or other." In view of this it is useless merely to assert that ants as a class are left alone by insectivorous animals and that hence ant mimicry would be of high protective value to the spider. Then, what advantage does this spider have by going out of its way to imitate the ant?

That this mimicry is of some protective value I am convinced; but the usual way of explaining the protective significance is faulty, for it is based on the assertion that ants are rarely taken by insectivorous animals. A closer study of the habits and behaviour of these organisms, however, reveals certain facts hitherto ignored, but which seem to me, to afford a satisfactory explanation of this phenomenon.

In the first place, we have to remember that the ants are so numerous and that the spiders moving about amongst them so few and scattered that the chance of the spiders for escape even under the worst conditions is very great. The vast majority of the victims would naturally be from the major species, the scattered individuals very often being ignored or missed.

But a far more important factor may be recognised in the different modes of behaviour of the ants and the spiders when confronted by danger. When an intruder is sighted the ants rush forward; they never slink away and so they easily fall a prey to such animals as possess the power to resist their attacks and feed on them. But the *Myrmarachne* which may be moving about on an adjoining leaf or twig, as soon as it sees the possibility of danger, the approach of any stranger, it by a sudden movement hides under cover of a leaf. The prey-hunter loses its prey; but it never has to search for the hidden quarry. All around run the Red Ants, which boldly, in their characteristic aggressive manner, hasten to the intruder which can, to the best of its ability, feed on them. That this fact has hitherto been overlooked is nothing to be wondered at when we remember that much of our knowledge of ant-mimics comes from preserved collections, there being only scanty notes on their real behaviour and habits from field observers. *Thus we see that by ant-mimicry the Myrmarachne has lessened its probable persecutors to a great extent, the common enemies of spiders more or less leaving it free. Even from the ant-feeding forms, it gains comparative safety due to its shy nature and quicker movements as contrasted with the bold and assertive behaviour of the ants.*

Ant mimicry is certainly of considerable protective value to the spider. Perhaps, it is a consequence of this protection that the fertility in this spider is rather low. This low fertility in ant-mimicking spiders is usually regarded as an indirect proof of the protective value of ant-mimicry. It is pointed out that whilst spiders as a group are highly prolific, laying several hundreds of eggs at a time, these mimicking spiders lay only a few eggs. *Myrmarachne plataleoides* lays only 15-20 eggs at a time. In certain other kinds of ant-mimicking spiders the reduction of the number of eggs laid has gone still further; for, some of them appear to lay only three or even two eggs at a time!

While the reduction of the fertility of the ant-mimicking spiders is very significant and lends strong indirect evidence to the protective value of mimicry, it should be noted that the comparison of this with the prolificity of the *Epeiridae* gives rather an exaggerated idea of this reduction. The *Attidae* generally lay only a small number of eggs compared with the *Epeiridae*. The ordinary Attid spiders which are no ant-mimics lay only about 20-30 eggs in a cocoon. It is with these that the productivity of the Attid ant-mimics should be properly compared.

Here, however, a puzzling question confronts us. *M. plataleoides* mimicking the Red-Ant is protected and in the light of this, its low fertility is intelligible. But we also know that destruction among young spiders is very great and so if these few young ones are not protected in some way they would not be able to maintain their numerical strength. Protection during one stage in life alone will not be efficient. If the spider is protected only

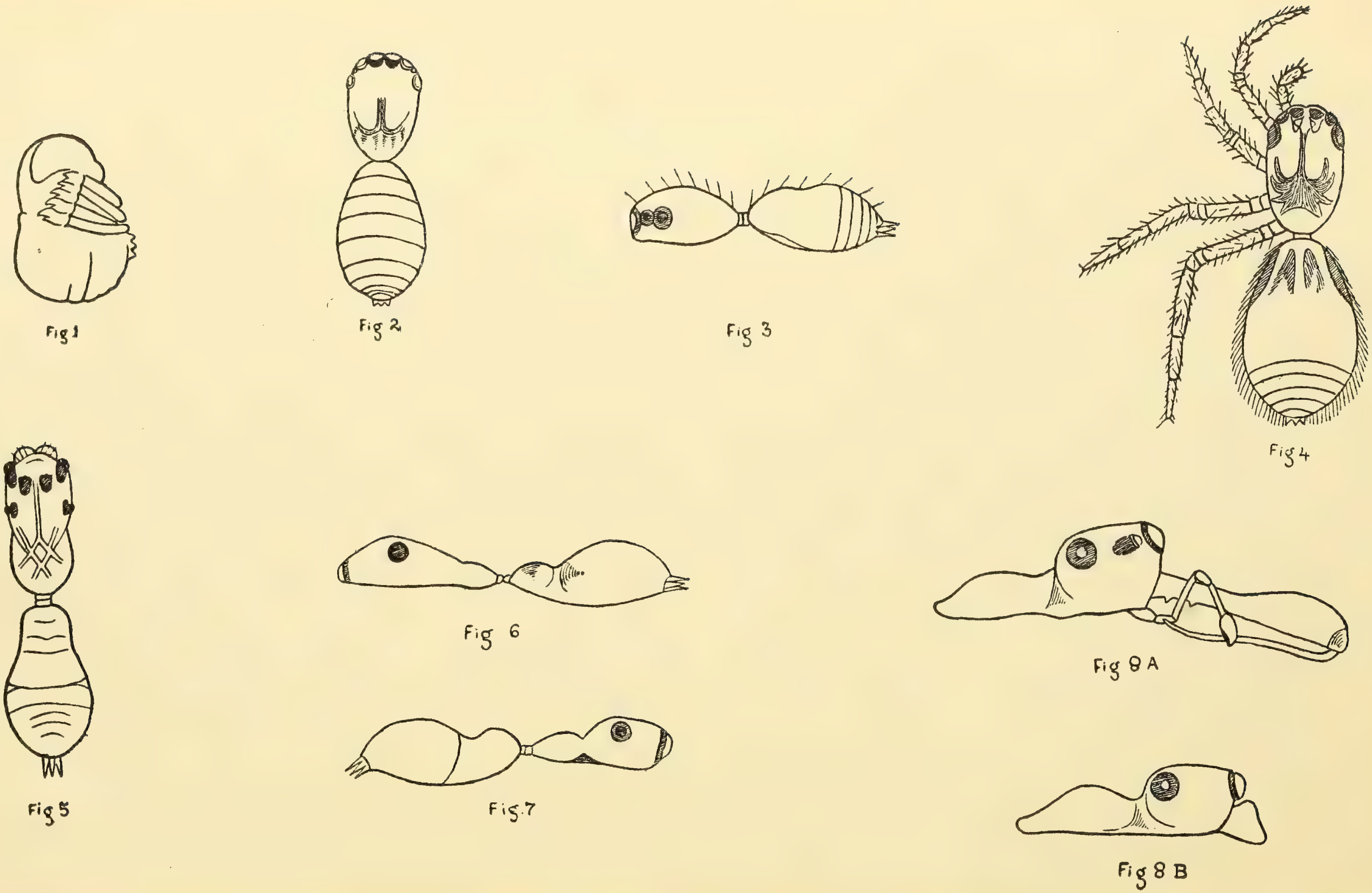

Fig 1

Fig 2

Fig 3

Fig 4

Fig 5

Fig 6

Fig 7

Fig 8 A

Fig 8 B

LIFE-HISTORY OF *Myrmarachne plataleoides* (Cambr.). (For explanation of figures see end of article).

during its adult stage while the other stages during which destruction seems to be very high, are left unprotected, the survival of the species with low fertility would be a serious problem. This difficulty has been already pointed out by McCook with regard to *Synageles picata*, an American Ant-mimicking spider which lays only three eggs! As far as I am aware no proper solution to this has, as yet, been offered.

Are the earlier stages of this spider unprotected or, do they have some means of protection? If so, how are they protected? To understand this I made a study of the life-history of the spider *M. plataleoides*. It revealed many interesting facts; a brief account of this as I observed during the last three years is given below.

The spider as has been mentioned above, lays about 15-20 eggs at a time, which are enclosed in a cocoon or nest constructed on a leaf. Over this cocoon a silken canopy is spun beneath which the spider-mother remains guarding the eggs while they are being hatched.

In a week's time the eggs appear to hatch. The egg-membrane splits and the embryo escapes from it. The limbs are formed but are glued to the body and the curious little animal is incapable of movement. The front part of the body is translucent while the hinder portion is yellowish and rounded with stored yolk. In this condition it remains only for a very short period for, in two days it undergoes the first moult while still within the cocoon (Fig. 1).

*The Spiderling* (Fig. 2).—The spiderling as the little spider after the first moult may be called, has its limbs all free. Though it can now move, it does not make free use of its limbs but remains more or less quiet in the silky tangle of the cocoon. It is quite a plumpy individual of a yellowish colour. It has no particular similarity to the ants, the cephalothorax not possessing the characteristic constrictions. In this stage if the cocoon is opened the spiderlings shun the light and show great anxiety to crawl into the depths of woolly mass of the nest; otherwise they remain quiet but for certain slow movements of the legs which take place every now and then. It is more or less translucent, pigments being absent; and in many respects the creature is incomplete. The spinnerets, the jaws and the sense organs are not fully developed and the individual does not feed. Till it leaves the cocoon, the young spider is dependent on the yolk retained within its body.

In two days' time the hinder portion of the abdomen becomes dark blue with certain whitish transverse bands caused by rows of white hairs. The ocular region is now distinct and the eyes are marked by dark pigmentation. The arrangement of the eyes, however, is quite different from that seen in the adult or even in the next stage. The spinnerets too are completed and produce silk but in very small quantities. The little spiders are not very active but when disturbed they crawl about and the little silk thread which hardens slowly may be noted attached to the spinnerets.

*The Second Moult* (Figs. 5 & 6.)—In about a week's time the yellow spiderlings moult. They have now become distinctly elongated and are clearly ant-like. All the yolk in the abdomen has been used up and it is now thin and elongated. The eyes are all developed. The young spiders remain for a considerable period within the cocoon. However, if the cocoon is disturbed or opened they rush out and move about in a very active manner. *It is in this stage that they finally emerge from the cocoon.* They are ant-like in form and movements. Like the adults these lift up their first pair of legs and wave them continuously as they move about.

The body is dark coloured with a deeper colouration for the cephalic part and for the hinder half of the abdomen. The young spider at this stage possesses a very striking similarity to the small dark brown ants so common here (*Prenolepis*) and also, to a less extent, to the small black ants (*Dolichoderinae*). It is interesting to note that these spiders, in this stage, are often seen in the company of these ants or in proximity to their nests. Whether they deliberately choose such localities is more than one can ascertain; for, quite often, they have been encountered in other situations as well, not particularly close to any dark ant colony.

What really happens seems to be this. In this stage the young spiders leave the cocoon often waiting for suitable fine weather. They emerge and swarm up the twigs in a most busy manner. They do not wait to reach the topmost twigs but immediately spin forth silk threads, which the first gust of wind catches, and they are carried away to diverse places. It is quite likely that many of these individuals are thus brought to places near which there are nests or colonies of the dark brown or black ants. Some of course would be carried to localities away from these ants, but this is less likely, since most trees on which they would land, would have some type or other of these little ants on them. Be this as it may, it is clear that this similarity to these well-known types of ants must be of high protective value to the spiders and quite naturally this would be more efficient in the proximity of their models than away from them.

From this stage the development of the young spiders is not quite uniform. Some individuals moult rapidly, and go through their life history in a shorter time than others. It has been found that males generally get through their life cycle much more rapidly than females. Another interesting feature noted after this stage is that the shades of colour of the spiders vary to a certain extent.

*The Third Moult.*—The next moult takes place after an interval of time—varying from nine days to a month. To a certain extent, this *variability* seems to depend upon the food supply. The spiders are now large and the colour of most of them turns a shade lighter. As a rule, they are neither too big nor too light coloured to lose their similarity to the small brown ants. Some however retain the dark colouration of the previous stage, while others become quite reddish yellow, the hinder half of the abdomen alone retaining the dark colour. These latter manifest a very real resemblance to the small stinging ants, the *Solenopsis* so common here.

*The Fourth Moult.*—The next moult also takes place after varying intervals in different specimens. The shortest period observed was 16 days. At this moult, there is a definite tendency for the spiders to assume a lighter colour. Most of them are yellowish brown and when they move about with the front legs stretched forth and waving, they resemble the *Plagiolepis* ants to a remarkable extent. I have taken specimens of this spider at this stage from plants on which a number of these ants were busy; but quite often these young spiders have been found in other situations as well.

The size and colouration of the spiders at this stage might also entitle them to be regarded as mimics of the minor workers of the Red ant *Oecophylla;* but it is decidedly from the next stage onwards that they put on the most striking similarity to this ant. However, near a stream of Red Ants in which the minor workers are mingled with the major workers, the spiders at this stage may quite easily pass for one of these minor workers. In this connection it is worth while noting that the *Oecophylla* ants are graded into major and minor workers which enable the later immature stages and the smaller individuals of the adults themselves—for the adult spiders are known to vary considerably regarding their size—to have suitable models.

*The Fifth Moult.*—The earliest interval after which the next moult takes place is two weeks. After this moult, the spiders are in the penultimate stage and have almost attained the adult size and are perfect mimics of the *Oecophylla.*

*The Sixth Moult.*—These in another three weeks, at the earliest, undergo the final moult. In this adult stage the sexes differ in appearance from each other—the male being larger and easily distinguishable from the female by the possession of a pair of horizontally extended chelicerae in front.

Such is the interesting life-history of this spider. It is clear from the above that the young ones are not left unprotected but that they too share in the advantages of mimicry. But if they are mimics, what are their suitable models? The *Oecophylla* which is mimicked by the adult, it is true, lays eggs but the tiny creatures that come out of them are not in the least ant-like, and when at last they put on their final garb they are too big for the spiderlings to serve as models. The young spider cannot mimic the mature Red ant—the model of the adult, however, by a slightly altered colouration it becomes a perfect mimic of some other species of ant that is more or less approximate to it in size. Thus the young *M. plataleoides,* which just escape from the cocoon, are so like the small brown ants that they may easily be mistaken for them while in their proximity. I have many times come across these spiders on plants infested by the brown ants and I hold that distinction between the spider and the ant under these conditions is not quite easy. Later on they mimic other types of ants and show corresponding modifications in general appearance and colouration.

This is a unique life-history. The spider is not only an ant-mimic in its adult stage but the privileges of ant-mimicry seem to be extended throughout its life-history. A few instances comparable to a certain extent with this life-history have been described by certain observers. In 1908, Vosseler gave an account of the African Tettigoniid, *Eurycorypha* which begins life as an ant-mimic but becomes leaf-like in the final stage. It is interesting to note that the ant-like larva of *Eurycorypha* has long been described under a different generic name *Myrmecophana* and thus supposed to be quite a different animal.

In the *Transactions of the Entomological Society* for 1922, Mr. Uvarov gives an account of *Leptoderes ornatipennis*—a leaf-like long-horned grasshopper from Java—which first mimics a *Collyris*, one of the tiger beetles, and later the *Tricondyla*, another genus of tiger beetles and in the final stage resembles a leaf. Another transformation beginning in an ant-like larva and ending in a leaf-like adult has been described in the life-history of an Indian grasshopper *Isopsera pedunculata* by Major Hingston in the *Journal of the Bombay Natural History Society*, vol. xxxiii, No. 3, p. 497. I have observed a similar life-history in the case of a common mantis and a bug from South India an account of which will be given elsewhere.

Such cases, where one insect mimics in different stages of its post-embryonic development certain other insects such as different ants or tiger beetles and finally assumes the shape and colouration of a leaf, have been termed '*Transformational Deceptive Resemblance*'. The life-history of *M. plataleoides* given above, however, differs from these instances in that it resorts to only one type of protective resemblance in its life-history namely mimicry, while these examples show mimicry at the earlier stages which later on passes into protective colouration. In the life-history of *M. plataleoides* full advantage seems to have been taken of the fact that the general plan of structure of the ants is so uniform. An alteration of colour corresponding to a difference in size makes the spider in its successive post-embryonic stages a successful mimic of different types of ants.

Since all through the different stages of this spider, it manifests the phenomenon of mimicry and since during these successive stages by certain slight alterations in appearance and colouration it mimics different kinds of ants, it is suggested that this restricted type of 'Transformational Deceptive Resemblance' may be called 'Transformational Mimicry'.

### EXPLANATION OF THE TEXT-FIGURES.

Fig. 1.—The young spider just escaped from the egg membrane.
Fig. 2.—The spiderling immediately after the first moult.
Fig. 3.—The spiderling—later stage—as seen from the side.
Fig. 4.—The spiderling—later stage—as seen from above.
Fig. 5.—The young spider after the second moult as seen from above. In this stage it escapes from the cocoon and has become ant-like.
Fig. 6.—The young spider after the second moult, as seen from the side.
Fig. 7.—The young spider after the third moult.
Fig. 8.—A. Front portion of the adult male.
B. Front portion of the adult female.

# ON THE TYPE LOCALITY AND SYNONYMY OF *EOGLAUCOMYS FIMBRIATUS* AND ITS LOCAL RACES.

BY

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[From the Department of Zoology, British Museum (Nat. Hist.).]

The type of *Sciuropterus fimbriatus* Gray (B.M. No. 37.6.10.55) is labelled as coming from 'India' and no more definite locality is given either on the label, or in Gray's original description of the species. This specimen was obtained by the Museum by purchase on the sale of the collection of Col. Cobbe on his death in 1836. Through the courtesy of the India Office I have been able to consult the record of service of Col. Cobbe in order to discover if at any time he was stationed anywhere within the area of distribution of this species. The result was negative. All the places mentioned in this record were in Central India or Bengal and it is probable that he received his specimen from friends stationed in the Hills and the most likely place from which he would have obtained it is Simla. I have compared the type with a series of specimens from Simla and they are, allowing for fading, identical. Therefore the typical locality for *Eoglaucomys fimbriatus* Gray, should be regarded as Simla until more definite evidence is forthcoming.

Examination of the large series of this species in the British Museum shows that it can be divided into two races; the eastern typical race, and a larger, lighter western race to which the name *baberi* Blyth is assignable.

The genus *Eoglaucomys* therefore contains one species divided into two races. They are:—

*Eoglaucomys fimbriatus fimbriatus* (Gray).

1837. Sciuropterus fimbriatus Gray, Mag. Nat. Hist., new series, vol. i, p. 584.

*Type locality.* Simla.

*Eoglaucomys fimbriatus baberi* (Blyth).

1847. Sciuropterus barberi Blyth, Journ., Asiat. Soc., Bengal, vol. xvi, p. 866.

*Type locality.* Mt. District Nijrow, Kohistan.

# A NOTE ON *SCIUROPTERUS GORKHALI* LINDSAY WITH REMARKS ON *PETAURISTA CANICEPS* AND ITS ALLIES.

BY

J. L. Chaworth-Musters.

[From the Department of Zoology, British Museum (Nat. Hist.).]

Helen Lindsay (*Journal, Bombay Natural History Society*, vol. xxxiii, No. 3, p. 565, 1929) described under the name of *Sciuropterus gorkhali* a species of flying squirrel from Nepal. In undertaking a revision of the Palaearctic *Pteromyidae* I had occasion to study the specimens upon which Mrs. Lindsay's species were based and after careful comparison, I have come to the conclusion that it cannot possibly be separated from *Petaurista caniceps* (Gray). Mrs. Lindsay was apparently led astray in her conclusions by two misunderstandings. In her paper she states that the two figures portraying *Sciuropterus senex* in Hodgson's 'Drawings of Mammalia' represent animals of different sizes. Reference to Hodgson's figures show that the two plates are drawn to different scales and the slight difference in colour may be easily accounted for by seasonal or individual variation or by the fact that the plates were drawn at different times and perhaps by different artists. Both plates portray a large Flying Squirrel with a grey head and we must believe that Hodgson realised that they portrayed the same animal when he labelled them with the same name. The skins which Mrs. Lindsay was studying were considerably shrunken owing to the fact that they had not been stuffed out with any material. On the other hand the skins of *Petaurista caniceps* and the type-specimens of *Sciuropterus senex* in the British Museum collection have no measurements taken in the flesh and may, as is often the case in old specimens be considerably over-stuffed. This has made comparison in regard to size extremely difficult, but measurements of the hindfoot and ear in the dry skin show that there is little difference between the species. I have carefully examined the skulls of *Sciuropterus gorkhali* and except for their slightly smaller size, as shown in Mrs. Lindsay's table of measurements, I can find no constant character by which they may be distinguished from the skulls of *Petaurista caniceps.*

Owing to this slight difference in size and its brighter colour *Sciuropterus gorkhali* must however be considered as a valid subspecies of *Petaurista caniceps.*

In regard to the systematic position of *Sciuropterus senex* the type-specimen B.M. No. 45.1.8. 242 is identical with specimens of *Petaurista caniceps* from Sikkim and it must be regarded as a synonym of that species.

From a careful examination of the material in the British Museum it is obvious that *Petaurista xanthotis* and *clarkei* must be considered as geographical races of *Petaurista caniceps*, and it is probable that this species through forms such as *Petaurista melanopterus*, *filchnerinae* and *watasei*, from Northern China and Manchuria, may connect up with *Petaurista leucogenys* of Japan and Korea. The material in the British Museum from Northern China is at present far too scanty to form a basis upon which to give a definite opinion as to whether all these forms should be considered races of one species *Petaurista leucogenys*.

The synonymy and races of *Petaurista caniceps* are:—

*Petaurista caniceps caniceps* (Gray).

1842. Sciuropterus caniceps Gray, Ann. Mag. Nat. Hist. Ser. 1, vol. x, p. 262.

1844. (Sciuropterus) senex Hodgson, Journ. Asiat. Soc., Bengal, vol. xiii, p. 68.

*Type-locality.* Darjeeling.

*Petaurista caniceps gorkhali* (Lindsay).

1929. Sciuropterus gorkhali Lindsay, Journal, Bomb. Nat. Hist. Soc., vol. xxxiii, p. 565.

*Type-locality.* Gorkha, Nepal, 12,000 ft.

*Petaurista caniceps xanthotis* (Milne Edwards).

1872. P[teromys] xanthotis Milne Edwards, Rech. Mamm., p. 301.

*Type-locality.* Moupin, Szechwan, Western China. (Thomas).

*Petaurista caniceps clarkei*, Thomas.

1922. Petaurista clarkei Thomas, Ann. Mag. Nat. Hist. Ser. 9, vol. x, p. 396.

*Type-locality.* Mekong Valley at 28° North, Western China, 9,000-10,000 ft.

# A NOTE ON THE BIRDS OF GHAZIPUR.

BY

REV. F. S. BRIGGS.

The town of Ghazipur lies in the Eastern part of the United Provinces, on the north bank of the Ganges. The Civil District of the same name also, lies, for the most part, on the north bank of the river, but one part of it, the Tehsil of Zamania, is on the south bank. Most of the District is under cultivation. In the immediate neighbourhood of Ghazipur itself there are large plantations of Guava, Mango, and Custard-apple. In parts there are wide stretches of *Usar* (barren ground), and there are occasional small patches of *Dak* jungle. The area liable to annual flooding, known locally as the *Diara* is of interest, as several species of birds are commoner there than anywhere else, and, in some cases, only occur there.

The climate is more like that of Bihar than of the greater part of the United Provinces, being very humid. The rainfall is not very heavy, being only about forty-five inches annually. But the fact that when the more western districts of the province are subject to the hot, dry west wind, or 'loo', Ghazipur generally has a damp east wind tends to increase the humidity of the atmosphere.

In the following notes subspecific identifications are only given where there can be no room for doubt. Unfortunately very few specimens were collected, hence the number of subspecific identifications is small.

For the sake of completeness I have added notes on species which have been observed in the Benares and Azamgarh Districts but not in the Ghazipur District. It seems probable that they also occur in the latter district. Such species, with the notes on them, have been enclosed in square brackets.

**Corvus macrorhynchos** Wagl. The Jungle Crow.

Numerous everywhere. The species breeds as freely in the station itself as in the surrounding country. Out of the breeding season Jungle Crows appear to gather nightly from a very wide area to some point so far undiscovered north-west of Ghazipur. Eggs are laid at varying times from the beginning of March to the end of April.

**Corvus splendens splendens** (Vieillot). The Indian House Crow.

Most of the remarks on the last species apply also to this one. They appear to roost in the same place as the last, as both Jungle and House Crows frequently fly north together at sunset. Eggs are laid in June, and the nests are more carefully concealed than those of the last species.

**Dendrocitta rufa** (Latham.) The Indian Tree-Pie.

A common pest. The number of eggs of small birds, particularly of Red-vented Bulbuls, destroyed by the Tree-Pie must be immense. This bird appears to breed in March, April, and possibly May, but is an adept at concealing its nest.

**Sitta castanea** (Lesson). The Chestnut-bellied Nuthatch.

Numerous wherever there are trees, but particularly in gardens. They occasionally catch small moths on the wing after the fashion of a Flycatcher. Judging from the time young birds begin to appear eggs are laid early in March.

**Turdoides somervillei** (Sykes). The Jungle Babbler.

Quite the commonest bird about Ghazipur. In the station every garden seems to have its flock. They are less common in the country. On October 16, 1930 a pair were seen feeding two young Pied Crested Cuckoos in trees opposite the compound of my bungalow. They appear to breed all the year round, but more commonly between March and August than at other times. There are no grounds for believing that they are anything but single-brooded.

**Argya caudata** (Dumont). The Common Babbler.

One seen in a Jasmine field on the outskirts of Ghazipur, 20-1-20. No other record.

**Argya malcomi** (Sykes). The Large Grey Babbler.

Extraordinarily local. A flock is always to be seen in some acacias at the south-west corner of the golf-links, except during the rains, when they seem to disappear. Apart from this flock I have only once seen the species, at the western corner of the District.

**Aegithinia tiphia** Linnaeus. The Common Iora.

Not seen during the cold weather. It was fairly numerous during the hot weather and rains of 1930, but was only seen about three times during the hot weather of 1931.

**Molpastes cafer saturatus** Whistler. The Red-vented Bulbul. ♂ 30-6-30, ♂ 19-7-30.

This species is less common about Ghazipur than in most parts of the Indian plains. The average height of their nests above the ground is greater than in other places. One nest I found was forty feet up a mango, and I have found none in this district below twelve feet. Eggs are laid from the middle of April till July, and possibly later.

[**Elathea jocosa** (Linnaeus). The Red-whiskered Bulbul.

This species was not observed in the Ghazipur District, although it is not uncommon at Benares, forty-five miles west, and is common at Azamgarh, about the same distance north.]

**Saxicola torquata** (Linnaeus). The Stonechat.

One seen at Mohammadabad, 6-11-29, and one or two near the northern boundary of the district the following autumn. Presumably all were on passage. It is surprising that this species is not commoner; and still more surprising that *Saxicola caprata* was not recorded at all.

**Oenanthe deserti** Temminck & Laug. The Desert Wheatear.

One seen perched on a mohwa tree, 24-1-30. No other record.

[**Cercomela fusca** (Blyth). The Brown Rock-Chat.

Not recorded in the Ghazipur District, but occurs at Azamgarh.]

**Phoenicurus ochrurus** (Gmelin). The Black Redstart.

A common winter visitor. The males appear to outnumber the females slightly. Earliest date seen September 11. Latest date not recorded.

**Cyanosylvia suecica** (Linnaeus). The Bluethroat.

Occurs in the cold weather, but not in great numbers. It is more often seen on the *Diara* than elsewhere, and is numerous there in tamerisk scrub in the spring. Latest date seen April 2. One white-spotted individual only was seen, 30-1-30.

**Calliope calliope.** (Pallas). The Rubythroat.

Two or three seen feeding in long grass and jasmine plantation on the outskirts of Ghazipur, 3-12-29.

**Saxicoloides fulicata cambaiensis** (Latham). The Brown-backed Indian Robin.

Resident in considerable numbers. Eggs are laid at least from the end of March to the beginning of July, and perhaps earlier and later than these dates.

**Copsychus saularis** (Linnaeus). The Magpie Robin.

Resident in smaller numbers than the last species. Breeds in the rains.

**Turdus atrogularis** Temminck. The Black-throated Thrush.

One seen 20-11-31. No other record.

[**Monticola solitaria** (Linnaeus). The Blue Rock-Thrush.

Not seen in the Ghazipur District, but one seen at Sarnath, Benares District, 25-2-30.]

**Siphia parva** (Bechstein). The Red-breasted Flycatcher.

Fairly numerous throughout the cold weather, and very much more so on migration, particularly in the autumn. Females (or juveniles) appear to arrive first. These were numerous at the end of October and throughout November and December in 1929, but no red-breasted males were seen till December 21. The same phenomenon was noted in the two succeeding years, but dates were not recorded.

[**Stoparola melanops** (Vigors). The Verditer Flycatcher.

Not recorded in the Ghazipur District, but one seen at Azamgarh, 4-12-31.]

**Tchitrea paradisi** (Linnaeus). The Paradise Flycatcher.

In the Ghazipur District this species appears to occur both as a passage migrant in the spring and autumn, and as a rains visitor. As passage migrants they pass through in April and May, and again in October. The breeding birds appear to be established about the middle of June, and to leave in September, immediately after breeding. Eggs are laid in the earlier part of July, mangoes and guavas being the trees most usually chosen for the nest.

**Leucocerca aureola** Lesson. The White-browed Fantail Flycatcher.

A resident in considerable numbers.

**Lanius excubitor** Linnaeus. The Grey Shrike.

This is the commonest of the four *Lanii* met with at Ghazipur, but is by no means common. The few that occur appear to be resident, and to keep closely to their breeding locality. They seem to occur only on *usar* and the *Diara*. They breed in March, and probably also in the rains.

**Lanius vittatus** Valenciennes. The Bay-backed Shrike.

One in immature plumage seen on the outskirts of Ghazipur 27-1-30, and one in adult plumage near the same spot 28-3-30. No other record.

**Lanius schach** Linnaeus. The Rufous-backed Shrike.

Occasionally seen at all seasons.

**Lanius cristatus** Linnaeus. The Brown Shrike.

One seen south of the Ganges 21-12-30. For two or three days in early December, 1931, they were very numerous on the Ghazipur golf-links. No other records.

**Tephrodornis pondiceriana** (Gmelin). The Wood-Shrike.

Fairly common wherever there is cover, particularly amongst the fruit-gardens round Ghazipur. Appears to be resident.

**Pericrocotus brevirostris** (Vigors). The Short-billed Minivet.

A winter visitor in small numbers.

**Pericrocotus perigrinus** (Linnaeus). The Small Minivet.

Numerous, but erratic in its occurrence. Its appearances and disappearances do not seem to be connected with the season. A flock which contained some young birds which could not, from their appearance, long have left the nest, was seen near the church at Ghazipur on 2-11-31.

**Graucalus macei** Lesson. The Large Grey Cuckoo-Shrike.

Fairly common, and appears to be resident.

**Lalage sykesii** Strickland. The Black-headed Cuckoo-Shrike.

Occasionally seen, never in the cold weather. One was seen building a nest in a mango on the outskirts of Ghazipur 16-7-31. The branch on which the nest was placed was blown down in a storm before it was laid in.

**Campophaga melanschista** Hodgson. The Dark Grey Cuckoo-Shrike.

Occasionally seen.

**Dicrurus macrocercus** (Vieillot). The Black Drongo or King Crow. ♂ 23-6-30, ♂ 10-7-30.

Numerous at all seasons. The majority of eggs are laid about the end of June and the beginning of July, but some are laid a good deal later, and possibly some earlier.

**Dicrurus longicaudatus** Jerdon. The Ashy Drongo.

Occasionally seen, most frequently in March, when the species sings. The song varies considerably in individual birds; but the best songsters amongst them are quite equal to the best performers among Indian birds.

**Dicrurus coerulescens** (Linn.). The White-bellied Drongo.

One seen on the outskirts of Ghazipur 5-11-29. One was seen, probably the same individual, in the same place for several days after this. No other record.

**Orthotomus sutorius** (Pennant). The Tailor-Bird.

Surprisingly scarce. One came into my bungalow to hunt for insects on several occasions, and a pair haunted the garden most of the two and a half years I was there, but elsewhere I very rarely met with the species.

**Cisticola juncidis** (Rafinesque). The Fantail Warbler.

Fairly numerous, particularly in fields of Jasmine. This species occasionally seems to disappear entirely without any visible reason.

**Phylloscopus inornatus** Blyth. The Yellow-browed Warbler.

One seen near Mahommedabad, 6-11-29. This was the only *Phylloscopus* (except *collybitus*) identified. On the whole *Phylloscopi* seem to be less numerous winter visitors in the Ghazipur District than in most parts of Northern India.

**Phylloscopus collybitus** (Vieillot). The Chiff-chaff.

Two seen 18-12-31, one of them singing rather half-heartedly.

**Prinia socialis** Sykes. The Ashy Wren-Warbler.

Fairly common, especially in sarpat and on the *diara*.

**Prinia inornata** Sykes. The Indian Wren-Warbler.

One of the commonest birds in the District. It appears in this District to build exclusively in sarpat, where the nest is not even very carefully concealed. Eggs are mostly laid in the last week of July and the first week of August.

**Oriolus oriolus** (Linnaeus). The Golden Oriole.

A summer visitor, and probably also a passage migrant. It appears at the beginning of April, but its numbers appear to decrease somewhat before the end of the month. Eggs are laid in June. It leaves early in October.

**Oriolus xanthornus** (Linnaeus). The Black-headed Oriole.

Occurs at all seasons, but in greater numbers in winter than in summer. The decrease in the number of Black-headed Orioles in the spring seems to coincide with the arrival of the Golden Oriole, and their autumn increase with the departure of the Golden Oriole.

**Pastor roseus** (Linnaeus). The Rosy Starling.

Occasionally seen, never in large numbers, between November and March.

**Sturnia malabarica** (Gmelin). The Grey-headed Myna.

Appears to be resident in small numbers. In February and March there seem to be more of these birds about, and they congregate at that season in great numbers round the blossoms of the Silk Cotton Tree. This increase may, however, be only apparent, as they are a good deal shyer and more difficult to observe than most members of their family.

**Temenuchus pagodarum** (Gmelin). The Brahminy Myna.

Resident in considerable numbers. Eggs laid in June; possibly also in May.

**Acridotheres tristis** (Linnaeus). The Common Mynah.

Very numerous. Out of the breeding season these birds appear to roost in the same neighbourhood as the Jungle and House Crows. The breeding season appears to extend from March to September, but the majority of eggs seem to be laid in July. In two successive years a pair of them built in a hole in the wall of my office after it had been vacated by a pair of Indian Spotted Owlets.

**Acridotheres ginginianus** (Latham). The Bank Mynah.

Fairly numerous. During the late summer and the cold weather they frequently feed in mixed flocks with other members of the same family. In April a large number of them disappear from their usual haunts, possibly to breed in some of the sand cliffs of the River Ganges. No large colonies of breeding birds observed, but two or three pairs may often be found breeding in a well. Eggs laid early in May.

**Sturnopastor contra** (Linnaeus). The Pied-Mynah.

Numerous and resident. In the autumn these birds come into the station, often feeding in mixed flocks with Common, Bank, and Brahminy Mynas. In the spring they leave the station for the surrounding country. Nests are built in Acacias, eggs being laid in July and August.

**Ploceus philippinus** (Linnaeus). The Baya or Weaver-Bird.

Resident, but not very numerous.

**Uroloncha malabarica** (Linnaeus). The White-throated Munia.

Resident and numerous. Most eggs are laid from January to March.

**Uroloncha punctulata** (Linnaeus). The Spotted Munia.

Occasionally seen, generally in small flocks in Jasmine gardens and Sarpat.

**Amandava amandava** (Linnaeus). The Red Munia or Amadavat.

Occasionally seen, sometimes in pairs, more often in flocks, either homogeneous or mixed with the last species.

**Carpodacus erythrinus** (Pallas). The Common Rosefinch.

A flock in which some of the males were beginning to assume breeding-plumage was seen 25-1-30. They occur from about that date till the latter half of February in varying numbers, giving the impression that they are passing through. None noted on the autumn passage.

**Gymnorhis xanthocollis** (Burton). The Yellow-throated Sparrow.

Appears to be resident in small numbers. Numbers increase in the spring.

**Passer domesticus** (Linnaeus). The House Sparrow.

Fairly numerous. Breeds irregularly, but chiefly in March and April. To overcome the nuisance of having these birds building inside their bungalows some of the European inhabitants put up nest-boxes in their verandahs. This measure seems quite successful, the Sparrows accepting the nest-boxes provided in preference to the inside of bungalows.

**Riparia paludicola** (?) (Vieillot). The Indian Sand-Martin.

Fairly numerous. Breeds in November. As no specimens were obtained it must remain doubtful whether the species is *paludicola* or *riparia*.

**Hirundo rustica** Linnaeus. The Common Swallow.

Occasionally seen in small numbers in October and November. Not recorded in any other months.

**Hirundo smithii** Leach. The Wire-tailed Swallow.

Occurs in small numbers in the hot weather and rains. Not noted in the cold weather.

**Hirundo daurica** Linnaeus. The Red-rumped Swallow.

Resident, breeding as soon as the rains break. In addition to the resident birds great numbers occur at intervals in the months of November, January, February, and March. When these large flocks appear they always seem to be entirely composed of very tired birds, which swarm on certain trees, especially mangoes and high bamboos. They rarely stay more than one day. Probably they belong to a different race from the resident birds, but unfortunately no specimens were secured.

**Motacilla alba** Linnaeus. The White Wagtail.

Exceedingly numerous from October to March. Earliest date seen October 5. Latest date not noted.

**Motacilla cinerea** Tunstall. The Grey Wagtail.

Fairly numerous, but never in flocks, throughout the cold weather.

**Motacilla flava** Linnaeus. The Grey-headed Wagtail.

Occurs throughout the cold weather, but in greater numbers in spring and autumn than in the winter months. Both on migration and when established in winter quarters mixed flocks of this species and *M. alba* are by no means uncommon.

**Anthus trivialis** (Linnaeus). The Tree-Pipit.

A winter visitor in large numbers (October to March).

**Anthus richardi rufulus** (Vieillot). The Indian Pipit.

Occasionally seen, chiefly on '*usar*', at all seasons.

**Calandrella acutirostris** Hume. The Short-toed Lark. ♂ 7-4-30.

The above specimen was shot from a large flock on the '*diara*'. They occur in autumn and spring, but I have not noted them in the winter.

**Mirafra erythroptera** Blyth. The Red-winged Bush-Lark.

Occasionally seen, almost invariably on '*usar*', at all seasons.

**Galerida cristata chendoola** Franklin. The Indian Crested Lark. ♂ December 30.

Not uncommon on the '*diara*' and on '*usar*'; rarely seen elsewhere. Resident.

**Ammomones phoenicura** (Franklin). The Rufous-tailed Finch-Lark.

Appears to be resident in small numbers.

**Erenropterix grisea grisea** Scopoli. The Ashy-crowned Finch-Lark. ♂♂♀ 2-10-30.

In the cold weather this bird occurs in large flocks on the '*diara*' and '*usar*'. In summer it occurs sparingly in pairs everywhere. The flocks appear to break up about the end of February.

**Zosterops palebrosa** (Temminck). The White-eye.

Fairly numerous, and appears to be resident. As in other places this species seems to appear at once in great numbers immediately after the fall of unseasonable rain. Eggs are laid in June and July.

**Cinnyris asiatica** (Latham). The Purple Sunbird.

Common at all seasons. The earliest date at which a male was seen in breeding plumage was November 17th, south of the Ganges. Nests containing eggs or young were found from February 21 to May 5. In this district the species seems to have a strong preference for prickly pears as a site for a nest. Every nest found, with two exceptions, were suspended from the thorns of prickly pear bushes. Of the two exceptions, one was suspended from a bush growing five feet below the surface of the ground in a disused well, and the other on a young neem inside a brick protector-wall.

**Piprosoma agile** (Tickell). The Thick-billed Flower-pecker.

Fairly common, and apparently resident. It is usually to be seen in mango groves.

**Liopicus mahrattensis** (Latham). The Mahratta Woodpecker.

Fairly numerous and resident.

**Yungipicus nanus** (Vigors). The Pigmy Woodpecker. ♂ 11-12-29.

This one specimen was obtained from a grove of mangoes on the south side of the Ganges. No other record.

**Brachypternus benghalensis** (Linnaeus). The Golden-backed Woodpecker.

Resident in considerable numbers, particularly in the station itself and the fruit plantations surrounding it.

**Iynx torquilla.** Linnaeus. The Wryneck.

One seen 20-2-31. No other record.

**Thereiceryx zeylanicus** (Gmelin). The Green Barbet.

Very numerous wherever there are trees. At no season is this bird completely silent. Any sudden noise at night wakes them up and sets them calling.

**Xantholema haemacephala** (P. L. S. Müller). The Coppersmith.

Numerous and resident. Most eggs are laid in April. From an excavation begun on the seventeenth of March two eggs were taken on the seventeenth of April.

**Hierococcyx varius** (Vahl). The Common Hawk-Cuckoo, or Brainfever Bird.

Appears to be a summer visitor only, though the fact that even when calling this bird is more often heard than seen makes one wary of stating that none remain for the winter. During the hot weather and the rains the Brainfever Bird occurs in large numbers. The earliest date at which it was heard calling was February 13th. From that time till the end of September or beginning of October there are few days on which it may not be heard. Its vocal activity is greatly increased immediately on the breaking of the rains.

**Clamator jacobinus** (Boddaert). The Pied Crested Cuckoo.

Occurs in large numbers as a rains visitor. In 1930 it was first recorded on June 17th, and in 1931 on June 15th. It grows noticeably scarcer in September, and the last appears to have left by the end of October. On 16-10-30 two juveniles were seen being fed by one pair of Babblers in trees opposite my bungalow. The species is not particularly shy. On one occasion one was seen feeding on the ground only twenty yards to the right front of the firing point of the rifle range during rifle practice.

**Eudynamis scolopaceus** (Linnaeus). The Koel.

A numerous summer visitor. Earliest date seen and heard February 21.

**Taccocua leschenaulti** Lesson. The Sirkeer Cuckoo.

Fairly numerous and resident. Chiefly seen on *usar* and open arable land.

**Centropus sinensis** (Stephen). The Coucal or Crow-Pheasant.

Common and resident. Eggs laid in July.

**Psittacula krameri** (Scopoli). The Green Parrakeet.

Common at all seasons wherever there are trees. Eggs laid in the earlier part of April.

**Psittacula cyanocephala** (Linnaeus). The Blossom-headed Parrakeet.

Seen at all seasons on the northern borders of the District, but not elsewhere. This species is kept as commonly in cages locally as the last.

**Coracias benghalensis** Linnaeus. The Blue Jay or Indian Roller.

Common and resident. The mating-flight is commenced as early as the third week in February.

**Merops orientalis** Latham. The Green Bee-eater.

Common at all seasons.

**Merops superciliosus** Linnaeus. The Blue-tailed Bee-eater.

This bird is numerous, especially over tanks, in July, and is occasionlly seen in the following two months. I have no record of it at any other season.

**Ceryle rudis** Linnaeus. The Pied Kingfisher.

Occurs wherever there is suitable water.

**Alcedo atthis** (Linnaeus). The Common Kingfisher.

Appears to be resident on those village ponds which hold water all the year round. In the rains they spread to those ponds which only hold water for part of the year, staying there till they dry up in the late winter. Not noticed on the river or large tanks.

**Halcyon smyrnensis** (Linnaeus). The White-breasted Kingfisher.

Occasionally seen at all seasons. In the Ghazipur District this species is noticeably scarcer than in most parts of the plains of northern India.

**Tockus birostris** (Scopoli). The Grey Hornbill.

Occasionally seen, chiefly in spring.

**Upupa epops** Linnaeus. The Hoopoe.

Very numerous at all seasons. Eggs are laid from the latter part of February and throughout March.

**Micropus affinis** (Gray). Indian House-Swift.

Numerous and apparently resident.

**Tachornis batassiensis** (Gray). The Palm-Swift.

Resident in considerable numbers. They breed in November, and possibly again in the spring.

**Caprimulgus macrourus** Horsefield. The Long-tailed Nightjar.

One seen at Sayedpur, 5-8-30. No other record.

**Caprimulgus monticolus** Franklin. Franklin's Nightjar.

Not uncommon in the station itself in the summer months. Numerous in the grounds of Ghazipur Club in the latter half of October and the earlier half of November.

**Caprimulgus asiaticus** Latham. Indian Nightjar.

Fairly numerous, and appears to be resident.

**Tyto alba** (Scopoli). The Barn Owl.

One seen near the railway between Sayedpur and Ghazipur, 9-11-29. No other record.

**Athene brama** (Temminck). The Spotted Owlet.

Very numerous. At least two pairs bred in my compound each year, one in a hollow Mohwa tree, and the other in a hole in a verandah wall. Eggs are laid about the end of February and the beginning of March. Observation of the nest in my verandah showed that both sexes take a share in incubation. All day one of the Owlets, apparently the male, sat on one of the verandah pillars, his eyes fixed on the entrance to the nesting hole, till about 2-30 or 3 p.m. At that time the one that had been sitting used to join the one on the pillar, and, after exchanging a few caresses, the one on the pillar went onto the nest, while the one from the nest flew off to feed.

**Glaucidium radiatum** (Tickell). The Jungle Owlet.

Fairly numerous at the west end of Ghazipur, in the now almost abandoned Cantonment. Rarely seen or heard elsewhere.

**Pandion haliaëtus** (Linnaeus). The Osprey.

One seen near Mohammedabad, at the east end of the District, 6-11-29. No other record.

**Sarcogyps calvus** (Scopoli). The King Vulture.

Common and resident. Several pairs of this species may often be seen at the same carcass.

**Gyps indicus** (Scopoli). The Indian Long-billed Vulture.

Less numerous than the last species.

**Pseudogyps benghalensis** (Gmelin). The White-backed Vulture.

The commonest Vulture at Ghazipur.

**Neophron percnopterus** (Linnaeus). The Neophron.

Not as numerous as in most parts of India.

**Gypaëtus barbatus** (Linnaeus). The Lammergayer.

One seen on the northern border of the district, 27-2-31. No other record.

**Falco jugger** A. E. Gray. The Lagar Falcon.

One seen near Mohammedabad, 6-11-29. Not identified with certainty on any other occasion.

**Falco tinnunculus** (Linnaeus). The Kestrel.

Occasionally seen in the cold weather. One seen near Shahabpur on 3-1-30 was an unusually brightly coloured bird for the Indian Plains.

**Aquila rapax** (Temminck). The Tawny Eagle.

Fairly common.

**Butastur teesa** (Franklin). The White-eyed Buzzard.

Resident in small numbers.

[**Haliaëtus leucoryphus** Pallas. Pallas's Fishing Eagle.

A pair seen on Ghosi Jhil (just over the border of the Azamgarh District) 27-12-30. One was attacking Coot, which huddled together on the water in flocks of from forty to sixty strong for protection. It caught one on the wing, but dropped it, apparently unhurt.]

**Haliastur indus** (Boddaert). The Brahminy Kite.

Common and resident. It is common over the river, but most frequently seen over village tanks.

**Milvus migrans** (Boddaert). The Common Pariah Kite.

Not as numerous as in many other parts of India. Eggs laid in January and February.

**Circus macrourus** (S. G. Gmelin). The Hen Harrier.

Occasionally seen, chiefly over *usar*, in the cold weather.

**Circus cyaneus** (Linnaeus). The Pallid Harrier.

As the last.

**Circus aeruginosus** (Linnaeus). The Marsh Harrier.

Commoner from September to April than either of the last two species. Seen on every kind of open country.

**Buteo rufinus** (Cretz). The Long-legged Buzzard.

One seen 25-11-30. No other record.

**Crocopus phoenicopterus** (Latham). The Common Green Pigeon.

Fairly numerous, and apparently resident, but moving about within the district in accordance with the food-supply. A pair shot on 3-1-30 each had their crops stuffed with peas, which disproves the commonly made assertion that the species *never* comes to the ground.

**Columba livia** Bonnaterre. The Blue Rock-Pigeon.

Resident, breeding irregularly throughout the year.

**Streptopelia chinensis** (Scopoli). The Spotted Dove.

Fairly numerous and resident.

**Streptopelia senegalensis** (Linnaeus). The Little Brown Dove.

As the last species.

**Streptopelia decaocto** (Frivaszky). The Indian Turtle-Dove.

The commonest of the Doves in this District.

**Oenopopelia tranquebarica** (Herman). The Red Turtle Dove.

Appears to be a hot weather visitor only in small numbers. Eggs laid in April.

**Pterocles exustus** (Temminck). The Common Sandgrouse.

A flock of about a dozen was seen flying over Nagsar Railway Station, south of the Ganges, 18-3-30. No other record.

**Coturnix coturnix** (Linnaeus). The Common Quail.

A winter visitor in surprisingly small numbers. Occurs more commonly on the *Diara* than elsewhere.

**Francolinus pondicerianus** (Gmelin). The Grey Partridge.

Resident in small numbers.

**Amaurornis phoenicura** (Pennant). The White-breasted Waterhen.

Fairly common, chiefly on well-shaded village ponds. This bird is regarded as a delicacy by the Chamar caste.

**Ammurornis akool** (Sykes). The Brown Crake.

Occasionally seen south of the Ganges.

**Gallinula chloropus** (Linnaeus). The Waterhen.

A few seen on Ghosi Jhil 27-12-30. No record within the borders of the District.

**Porphyrio poliocephalus** (Latham). The Purple Coot.

One seen on the village tank at Barodi, near the northern border of the district, 2-1-30. No other record.

**Fulica atra** Linnaeus. The Common Coot.

Common on all tanks and jhils of any size. Also occurs on the Ganges. On 16-3-30. on the river a House Crow was seen attacking a Coot. The latter dived at each swoop of the Crow to avoid it.

**Anthropoides virgo** (Linnaeus). The Demoiselle Crane.

Occasionally seen in the cold weather.

**Burhinus oedicnemus** (Linnaeus). The Stone-Curlew.

Resident in considerable numbers. Eggs mostly laid in April, but possibly both earlier and later as well.

**Glareola lactea** Temminck. The Little Indian Pratincole.

Resident in large numbers on the Ganges. Eggs are laid in the earlier half of April. When the rains bring out the swarms of flying termites these birds may be seen catching them on the wing in large numbers at a considerable distance from the river.

**Cursorius coromandelicus** (Gmelin). The Indian Courser.

Fairly numerous, and appears to be resident. The flesh of these birds is by no means bad eating.

**Metapodius indicus** (Latham). The Bronze-winged Jacana.

Numerous on all large jhils. Breed in the latter part of the rains.

**Hydrophasianus chirurgus** (Scopoli). The Pheasant-tailed Jacana.

Even more numerous than the last species, breeding on small tanks as well as on the larger jhils. A pair watched courting on 11-8-30 flew higher and higher till they amost receded from sight.

**Lobivanellus indicus** (Boddaert). The Red-wattled Lapwing.

Common and resident. In April 30 a pair laid their eggs on the flat roof of the Ghazipur Church.

**Hoplopterus duvaucellii** (Lesson). The Spur-winged Plover.

Seen on several occasions on sandbanks on the Ganges, and probably breed there, but no eggs were found.

**Squatarola squatarola** (Linnaeus). The Grey Plover.

Several feeding on the sand by the Ganges 30-4-31. No other record.

**Charadrius dubius** Scopoli. The Little Ringed Plover.

Occurs in small numbers in the winter.

**Himantopus himantopus** (Linnaeus). The Black-winged Stilt.

Occurs in small numbers in the cold weather.

**Recurvirostris avocetta** Linnaeus. The Avocet.

Pair seen over the Ganges 27-4-31. No other record.

**Numenius arquatus** (Linnaeus). The Curlew.

Occurs in small flocks on the banks of the Ganges in winter.

**Tringa hypoleuca** Linnaeus. The Common Sandpiper.

A winter visitor in small numbers. Rather more numerous as a passage migrant in the autumn. Earliest date recorded October 10.

**Tringa ochropus** Linnaeus. The Green Sandpiper.

One or two wherever there is water in the cold weather.

**Tringa nebularia** (Gunner). The Greenshank.

Occurs in small numbers in the cold weather.

**Erolia minuta** (Leisler). The Little Stint.

Fairly numerous, chiefly in pairs or small parties up to half a dozen, throughout the cold weather. More numerous as a passage migrant both in spring and autumn. Latest date recorded April 2.

**Erolia temminckii** (Leisler). Temminck's Stint.

Less numerous than the last species.

**Capella gallinago** (Linnaeus). The Fantail Snipe.

Occurs wherever the ground is suitable in the cold weather.

**Capella stenura** (Bonaparte). The Pintail Snipe.

A pair seen near the Indian Cemetery 19-2-30. No other record.

**Larus ridibundus** Linnaeus. The Black-headed Gull.

One seen over the Ganges opposite the steamer ghat 16-3-30. No other record.

**Larus brunicephalus** Jerdon. The Brown-headed Gull.

Not uncommon on the Ganges from October to April.

**Chlidonias leucopareia** (Temminck). The Whiskered Tern.

Several seen over Birhanpura Tank, 15-9-30. They may well have bred there. No other record.

**Sterna nilotica** (Gmelin). The Gull-billed Tern.

One seen over the Ganges 28-4-31. No other record.

**Sterna seena** Sykes. The Common River Tern.

Very numerous at all seasons. They feed wherever there is water, but gather to sleep on two or three sandbanks opposite the old cantonment of Ghazipur. In the rains, when these banks are entirely submerged, they may still be seen towards dusk flying in the same direction. Eggs are mostly laid in the earlier half of April. They and *Rhyncops albicollis* frequently lay on the same sandbank, but I have found no other species breeding with these two.

**Sterna melanogaster** Temminck. The Black-bellied Tern.

Much less numerous than the last species. Appears to be resident, but no eggs taken. This species is rarely seen away from the river.

**Sterna albifrons** Vroeg. The Little Tern.

Fairly numerous on the river. Like the last species it does not often occur away from the river. Eggs are laid in the earlier half of April. It breeds in mixed colonies with the Pratincole.

**Rhyncops albicollis** Swainson. The Indian Skimmer.

Fairly numerous on the Ganges. Eggs are laid in the first half of April, and some before the end of March. It appears to breed either in homogeneous colonies or only mixed with Sterna seena.

**Anhinga melanogaster** Pennant. The Indian Darter.
Occurs in small numbers. Resident.

**Ciconia ciconia** Linnaeus. The White Stork.
Pair seen near Sadat, 2-1-30. No other record.

**Dissoura episcopa** (Boddaert). The White-necked Stork.
Common, but very local in its distribution. Local name Jangil. Amongst the lower castes of Hindus its flesh is esteemed a delicacy.

**Ibis leucocephalus** (Pennant). The Painted Stork.
One seen in a tank near Jakhanian, 5-2-30. No other record.

[**Ardea purpurea** Linnaeus. The Purple Heron.
Several seen on Ghosi Jhil, 27-12-30. No other record.]

**Ardea cinerea** Linnaeus. The Common Heron.
Appears to be resident in small numbers.

**Egretta alba** (Linnaeus). The Large Egret.
Seen at Shahabpur, 13-1-30. No other record.

**Bubulcus ibis** (Linnaeus). The Cattle Egret.
Fairly numerous and resident.

**Ardeola grayii** (Sykes). The Pond Heron or Paddy Bird.
Common wherever there is water.

**Nycticorax nycticorax** (Linnaeus). The Night Heron.
For some weeks at the end of 1930 two or three roosted daily in tall *nim* trees in my compound. No other record.

**Ixobrichus cinnamomeus** (Gmelin). The Chestnut Bittern.
One seen on the banks of the Ganges in the evening, Sayedpur, 26-10-31.

**Sarkidiornis melanotos** (Pennant). The Nukta.
Resident in small numbers.

**Nettopus coromandelicus** Gmelin. The Cotton Teal.
Resident and fairly numerous.

**Anser anser** Linnaeus. The Grey Lag Goose.
A fairly numerous winter visitor, occurring both on the Ganges and on tanks.

**Anser indicus** Latham. The Bar-headed Goose.
Less numerous than the last species.

**Dendrocygna javanica** (Horsfield). The Whistling Teal.
Numerous and resident.

**Casarca ferruginea** (Pallas). The Ruddy Sheldrake or Brahminy Duck.
Common in winter on the banks of the Ganges, sometimes seen on its tributaries. In the neighbourhood of Ghazipur most Europeans seem to believe that this bird feeds on corpses, and therefore avoid eating it. So far I have met no Indians who believe this, and its flesh is eaten by several castes.

**Anas platyrhyncha** Linnaeus. The Mallard.
Occurs occasionally in the cold weather, never in great numbers. In some years none are shot.

**Anas poecilorhyncha** Forster. The Spotbill.
Several seen on Bishanpura Tank, 15-9-30. No other record.

**Chaulelasmus streparus** (Linnaeus). The Gadwall.
Occurs in comparatively small numbers in the winter.

**Mareca penelope** (Linnaeus). The Wigeon.
A regular, but not very numerous winter visitor.

**Nettion crecca** (Linnaeus). The Common Teal.

Numerous throughout the cold weather and well into April.

**Querquedula querquedula** (Linnaeus). The Blue-winged or Garganey Teal.

By no means so numerous as the last species, but stays even later.

**Dafila acuta** (Linnaeus). The Pintail.

Occurs in the cold weather, but not in large numbers. It is more numerous as a passage migrant in the autumn than as a winter visitor.

**Spatula clypeata** (Linnaeus). The Shoveller.

Numerous throughout the cold weather.

**Netta rufina** (Pallas). The Red-crested Pochard.

A winter visitor in small numbers.

**Nyroca nyroca** Güldenstädt. The White-eye.

This appears to be the most numerous of the migratory Ducks in the District.

**Nyroca ferina** (Linnaeus). The Pochard.

Less numerous than the last species, but more so than *N. rufina*.

**Nyroca fuligula** (Linnaeus). The Tufted Duck.

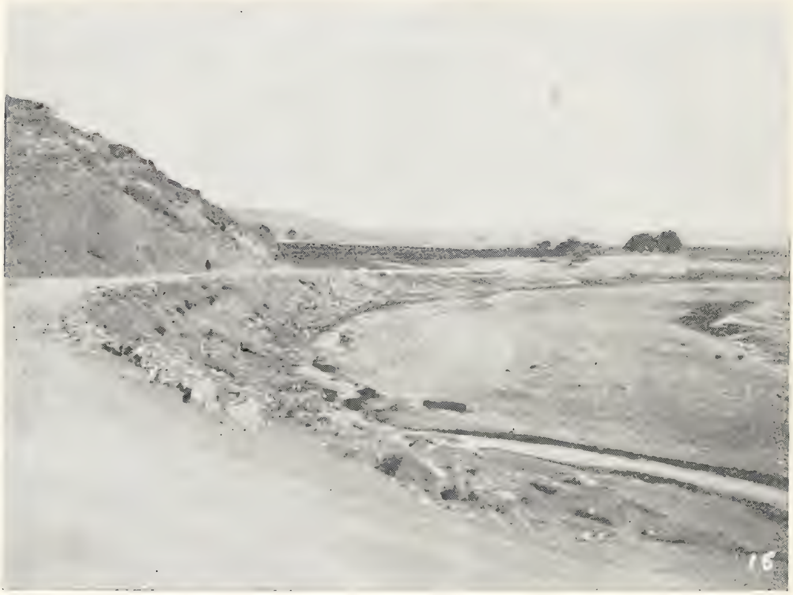
A few appear to be shot every winter, but they are never very numerous.

[**Podiceps cristatus** (Linnaeus). The Great Crested Grebe.

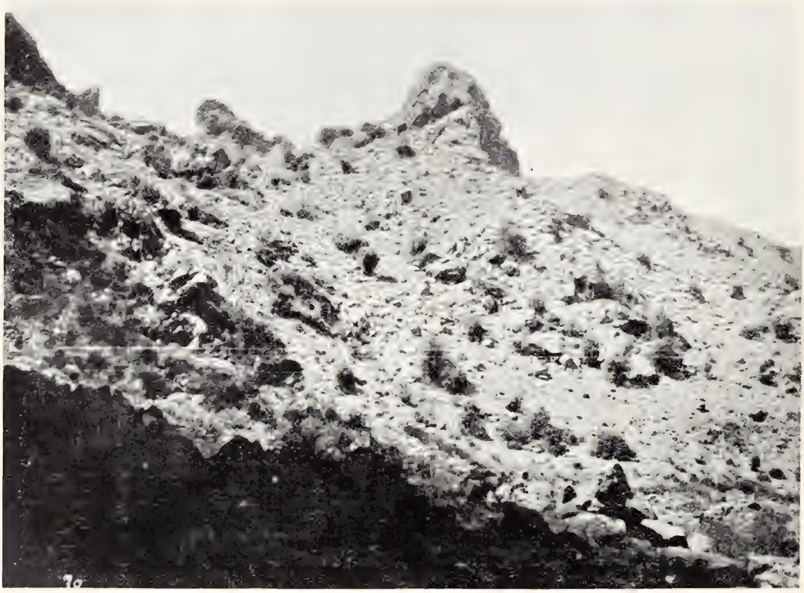
Very numerous on Ghosi Jhil, 27-12-30. Not seen within the borders of the District.]

**Podiceps ruficollis** (Vroeg). The Little Grebe.

Very numerous wherever there is permanent water. Eggs appear mostly to be laid in August, but some must be laid later, as a family of very young chicks was seen on a tank near my bungalow on 31-11-31 and for several days afterwards.



12. Right bank of Chasmai River near Miram Shah Fort.



13. A single peak of the hill-range E. of Miram Shah Fort. Plants *Monotheca buxifolia* Dcne., *Acacia modesta* Wall., *Nannorhops Ritchieana* H. Wendl., *Periploca aphylla* Decaisne. On the top *Periplora* and *Acacia modesta*.

*Photos by J. Fernandez.*

# THE FLORA OF WAZIRISTAN.

BY

THE LATE E. BLATTER, S.J., Ph.D., F.L.S. and J. FERNANDEZ.

PART IV.

(*Continued from page* 171 *of this volume*).

(*With* 3 *plates*).

## BIGNONIACEAE.

800 species.—Tropics.

### TECOMELLA Seem.

1 species.—Arabia, S.-W. Asia.

**Tecomella undulata** Seem in Ann. & Mag. Nat. Hist. ser. 3, x, 30.
*Vernacular name*: Regdawan (Pu.); Whira (Hind.); Ribdhvan (Waziri); Ribdunh (Mashudi).
*Locality*: *N.W.*: Shewa Post, on rocky bank (B. & F. 927 !).—Dwa Warkha, abundant (Stewart); Isha (B. & F. 927a !).
*S.W.*: Sararogha (F. 1 ! 15 ! 577 !).—Sarwekai (F. 1464 !).—Jandola (F. 4129 !).—Near Palosina (Stewart).—Barwand, 4,000 ft. (Duthie's Collect. 15637 !).
*Flowers*: April 1860 (Palosina, Dwa Warkha); 5-4-30 (Shewa Post); 28-4-1895 (Barwand); 15-5-27 (Sararogha).
*Distribution*: Punjab, Rajputana Desert, Sind, Baluchistan to Arabia.

### *TECOMA Juss.

90 species.—Tropical and warm temperate regions.

***Tecoma sp.**
*Locality*: *N.W.*: Miram Shah, garden, 3,150 ft. (B. & F. 39a !, F. 2365 !).
*Flowers*: 19-3-30 (Miram Shah); 12-4-27 (Miram Shah).

### *CATALPA Scop.

10 species.—America, E. Asia.

***Catalpa speciosa** Warder ex Engelm. in Coult. Bot. Gaz. v (1880) 1.
*Vernacular name*: Hardy Catalpa.
*Locality*: *N.W.*: Miram Shah (B. & F. 45 !).
*Distribution*: Indigenous in the United States.

## ACANTHACEAE.

2,000 species.—Especially tropics, but also Mediterranean, United States, Australia.

### HYGROPHILA R. Br.

40 species.—Tropics, in marshes.

**Hygrophila polysperma** T. Anders. in Journ. Linn. Soc. ix (1867) 456.
*Locality*: *S.W.*: Jandola, along Tank River (F. 789 !).
*Distribution*: Afghanistan, throughout India in wet places.

### LEPIDAGATHIS Willd.

80 species.—Tropics.

**Lepidagathis calycina** Hochst. ex DC. Prodr. xi (1847) 252.—*L. strobilifera* Stocks in Kew Journ. Bot. iv (1852) 177.

*Locality*: *S.W.*: Sararogha, in nala along slopes (F. 8 ! 9 ! 13 !)—Jandola (F. 240 ! 258 ! 274 !).
*Flowers*: 16-5-27 (Sararogha); 27-5-27 (Jandola).
*Distribution*: Sind, Baluchistan, Abyssinia.

**Lepidagathis sp.**—No flowers, no fruit. A stunted perennial. Leaves obovate, acute or cuspidate.
*Locality*: *S.W.*: Jandola, along Tank River (F. 708 !).

### ADHATODA Tourn. ex Medic.

100 species.—Tropics.

**Adhatoda vasica** Nees in Wall. Pl. As. Rar. iii, 103.
*Locality*: *N.W.*: Spinwam, forming a pure formation on conglomerate ridge W. of Fort (B. & F. 429 !).
*Distribution*: Almost throughout India, Malaya, S.-E. Asia.

### DICLIPTERA Juss.

100 species.—Tropics and subtropics.

**Dicliptera Roxburghiana** Nees in Wall. Pl. As. Rar. iii, 111, **var. bupleuroides** C. B. Clarke.
*Locality*: *N.W.*: Razani (Stewart).
*S.W.*: (Duthie's Collect. 15638 !).
*Flowers*: October 1860 (Razani).
*Distribution*: Throughout India in the hills, 1,000-6,000 ft., Himalayas, Central India, Afghanistan.

## VERBENACEAE.

750 species.—Almost all tropical and subtropical.

### LANTANA L.

60 species.—Tropics and subtropics.

**Lantana indica** Roxb. Hort. Beng. 46.
*Locality*: *N.W.*: Dwa Warkha (Stewart).
*Distribution*: Throughout India, Baluchistan, tropical Africa.

### LIPPIA Houst. ex L.

120 species.—Mostly tropical America, Africa.

**Lippia nodiflora** Rich. in Michx. Fl. Bor. Am. ii, 15.
*Locality*: *N.W.*: Khaisora River (Stewart).—Chasmai River, near Miram Shah, 3,100 ft. (B. & F. 315 !).—Shewa Post, right bank of Kuram River (B. & F. 925 !).—Miram Shah (F. 870 !).
*S.W.*: Sarwekai (F. 3654 !).—Jandola (F. 759 !).—Spin (F. 3543 !).
*Tank*: (Duthie's Collect. 15764 !, J. Williams 7186 !).
*Flowers*: 16-4-27 (Miram Shah); 12-6-27 (Sarwekai); 21-6-27 (Spin).
*Distribution*: All tropical and warm temperate regions.

### VERBENA L.

100 species.—Tropical and temperate regions.

**Verbena officinalis** L. Sp. Pl. 20.
*Locality*: *N.W.*: Dwa Warkha (Stewart).
*Tank*: (Duthie's Collect. 15732 !).
*Distribution*: Himalaya up to 6,000 ft., from Kashmir to Bhutan, temperate and tropical regions.

### VITEX Tourn. ex L.

75 species.—Tropical and temperate regions.

**Vitex negundo** L. Sp. Pl. (1753) 638.
*Vernacular name*: Marivande (Pu.); Warmandai (Waziri).

*Locality*: *N.W.*: Dwa Warkha, abundant (Stewart).—Spinwam (Stewart).—Near Datta Khel village, forming a rough hedge along water channel, 4,600 ft. (B. & F. 1435 !).

*S.W.*: Above Khirgi, groves frequent along the edges of the ravine (Stewart).—N. of Doboi, 5,000 ft., in damp places (Stewart).

*Flowers*: April, May.

*Distribution*: Throughout India and in Ceylon, N.-W. Himalaya up to 5,000 ft., Baluchistan, Afghanistan, extending to tropical Africa and Madagascar, and to China and the Philippines.

**Vitex agnus castus** L. Sp. Pl. 890.

*Vernacular name*: Marmandai (Mashudi).

*Locality*: *N.W.*: Boya, right bank of Tochi River, on sandy clay, 3,550 ft. (B. & F. 1682 !).—Below Spinwam Fort, along nala, 2,650 ft. (B. & F. 432 !).

*S.W.*: Sararogha (F. 2 ! 36 ! 188 ! 208 !).—Jandola, open stony ground and nalas (F. 644 ! 649 !).

*Flowers & Fruit*: 27-3-30 (Spinwam); 21-4-30 (Boya); 15-5-27 (Sararogha); 24-5-27 (Jandola).

*Distribution*: Baluchistan, Afghanistan, W. Asia, Mediterranean.

## PLANTAGINACEAE.

About 200 species.—Cosmopolitan.

### PLANTAGO (Tourn.) L.

200 species.—Cosmopolitan.

**Plantago saxatilis** M. Bieb. Taur. Cauc. i, 109.

*Vernacular name*: Khatakai.

*Locality*: *N.W.*: Boya, along irrigation channel, 3,550 ft. (F. 1155 ! 1155a !).—Boya Fort, on sand (B. & F. 78 !).—Miram Shah, 3,150 ft. (B. & F. 36 !).

*S.W.*: N. of Razmak Camp, 6,600 ft. (B. & F. 1255 !).

*Flowers & Fruit*: 19-3-30 (Miram Shah); 21-3-30 (Boya); 5-4-27 (Boya); 14-4-30 (Razmak).

*Distribution*: Macedonia, Orient, Persia.

**Plantago amplexicaulis** Cav. Ic. ii, 22, t. 125.

*Locality*: *N.W.*: Pigeons' Cave, on hill E. of Miram Shah Fort, 3,600 ft. (B. & F. 540 ! 552 !).

*Flowers & Fruit*: 29-3-30.

*Distribution*: Punjab Plains, Malva, Sind, Baluchistan, Afghanistan, westwards to Greece and Egypt.

**Plantago amplexicaulis** Cav. Ic. ii, 22, t. 125, **var. bauphula** (Edgew.) Pilger.—*P. Bauphula* Edgew. in Hook. Journ. Bot. ii (1840) 285.

*Vernacular name*: Isafgul.

*Locality*: *N.W.*: Pigeons' Cave, on a hill E. of Miram Shah Fort, 3,600 ft. (B. & F. 540 ! 552 !).

*S.W.*: In the lower regions (Stewart).

*Tank*: (J. Williams 7189).

*Flowers*: 5-5-1888 (Tank); September 1860 (S.W.).

*Distribution* of type.

*Uses*: Seeds used in dysentery (Williams).

**Plantago ovata** Forsk. Fl. Aegypt.-Arab. (1775) 31.—*P. Ispaghula* Roxb. Fl. Ind. i (1832) 404.

*Locality*: *N.W.*: Left bank of Chasmai River, 3,100 ft. (B. & F. 301 !).—Sandy clay E. of Miram Shah, 3,150 ft. (B. & F. 151 !).—Bed of Sua Algad, near Khajuri Post, 2,250 ft. (B. & F. 359 !).—Shewa Post, on sand and gravel, 2,150 ft. (B. & F. 938 !).—Tochi River near Miram Shah (F. 364 !).—At Boya, on gravel, 3,550 ft. (B. & F. 1691 !).—Miram Shah, on gravel, 3,150 ft. (B. & F. 482 !, F. 449 !).

*Flowers & Fruit*: 24-3-30 (Chasmai River); 26-3-30 (Khajuri Post); 28-3-30 (Miram Shah); 5-4-30 (Shewa Post); 12-4-27 (Miram Shah); 14-4-27 (Tochi River); 21-4-30 (Boya).

*Distribution*: N.-W. India, Sind, Turkestan, Persia, westwards to Spain and the Canaries.

**Plantago Loeflingii** L. Sp. Pl. (1753) 166.
*Locality*: *N.W.*: E. of Spinwam Fort, in sandstone nala, 2,650 ft. (B. & F. 677 !).—Plain W. of Spinwam Fort, on gravel, 2,650 ft. (B. & F. 853 !).—Miram Shah (F. 312 !).
*Flowers & Fruit*: 1-4-30 (Spinwam); 4-4-30 (Spinwam); 16-4-27 (Miram Shah).
*Distribution*: Persia, Caucasus, Mesopotamia, Syria, N. Africa, Canaries, Spain.

**Plantago coronopus** L. Sp. Pl. (1753) 166, **var. filiformis** (Koch) Muschler Fl. Egypt ii, 912.—*P. coronopus var. simplex* Boiss. Fl. Or. iv, 888.
*Vernacular name*: Khatakai.
*Locality*: *N.W.*: Razani (F. 2173 !).
*Flowers & Fruit*: 23-4-27 (Razani).
*Distribution of var.*: Persia, Transcaucasus, Mesopotamia, Egypt.

**Plantago ciliata** Desf. Fl. Atl. i, 137, t. 39.—*P. eriantha* Dcne. in DC. Prodr. xiii, 1, 708.
*Vernacular name*: Haidar boti (Williams); Kharbita (Waziri).
*Locality*: *N.W.*: In the lower regions (Stewart).—9 miles from Spinwam (B. & F. 690 !).—Sandstone nala E. of Spinwam Fort (B. & F. 654 !).—Miram Shah, on stony ground (B. & F. 319 !).—On boulder-strewn slope of Chota Darweshta, W. of Spinwam Fort, 3,000-4,800 ft. (B. & F. 695 ! 752 !).—On disintegrating limestone hills N. of Spinwam Fort (B. & F. 812 !).—Left bank of Volam River below Shewa Post (B. & F. 873 ! 891a !).—Plain W. of Spinwam on gravel (B. & F. 852 !).—Bed of Kuram River near Shewa Post (B. & F. 950 !).—Spinwam Fort, 2,600 ft. (B. & F. 775 ! 810 !).—Right bank of Sua Algad at Khajuri Post, 2,250 ft. (B. & F. 357 !).
*Tank*: Near Tank, Shaur Hill (J. Williams !).
*Flowers*: 29-5-1891 (Tank).
*Flowers & Fruit*: 26-3-30 (Khajuri Post); 1-4-30 (Spinwam); 2-4-30 (Chota Darweshta); 4-4-30 (Spinwam); 5-4-30 (Shewa Post); 16-4-27 (Miram Shah).
*Distribution*: Punjab Hills, Salt Range, Orient, Egypt.

**Plantago Lagopus** L. Sp. Pl. (1753) 165.
*Locality*: *N.W.*: Razani (F. 2193 ! 2195 !).—Datta Khel, along water channel in garden, 4,600 ft. (B. & F. 1,400 !).—Datta Khel, on gravel along irrigation channel, 4,600 ft. (B. & F. 1399 ! 1463 !).—Boya Fort, 3,550 ft. (B. & F. 116 !).
*S.W.*: N. of Razmak Camp, below Springs, 7,700 ft. (B. & F. 1822 !).—Razmak, below Springs (B. & F. 1821 !).—Hills S.-W. of Razmak, 6,950 ft. (B. & F. 1934 !).
*Flowers & Fruit*: 21-3-30 (Boya); 17-4-30 (Datta Khel); 23-4-27 (Razani); 25-4-30 (Razmak); 27-4-30 (Razmak).
*Distribution*: Orient, Mediterranean.

**Plantago lanceolata** L. Sp. Pl. 113.
*Vernacular name*: Shekai para.
*Locality*: *N.W.*: Dwa Warkha (Stewart).—5,000-8,000 ft. (Stewart).—Shakai, 6,000-7,000 ft. (Duthie's Collect. 15694 !).
*S.W.*: Pre Ghal (J. Williams 7957 !).
*Flowers*: 30-4-1895 (Shakai).
*Distribution*: W. Himalaya, Salt Range, Europe, N. Asia.

**Plantago lanceolata** L. **forma genuina** Boiss.
*Locality*: *N.W.*: Datta Khel, along water channels (F. 1278 !).
*S.W.*: Wana Plain, in marshes (F. 3488 !).—Razmak, on slope of hill (B. & F. 1933 !).
*Flowers & Fruit*: 25-3-27 (Datta Khel); 27-4-30 (Razmak); 16-6-27 (Wana).

**Plantago lanceolata** L. **forma altissima** Dcne. in DC. Prodr. xiii, 1, 714.
*Locality*: *N.W.*: S. of Miram Shah village, in river-bed of sand and gravel (B. & F. 508 !).—Miram Shah (F. 811 !).—Datta Khel village (B. & F. !).—Chasmai River, in clayey sand, 3,100 ft. (B. & F. 240 ! 240b !).—

From Boya to Datta Khel, along water channel, 4,500 ft. (B. & F. 590 !).—Near Spinwam Fort, in bed of Kaitu River (B. & F. 442 !).

*S.W.*: Slope of hill E. of Razmak, above 6,800 ft. (B. & F. 1923 !, F. 2010 !).

*Flowers*: 23-3-30 (Chasmai River); 27-3-30 (Spinwam); 28-3-30 (Miram Shah); 30-3-30 (Boya to Datta Khel); 16-4-27 (Miram Shah); 26-4-30 (Razmak); 30-4-27 (Razmak).

*Distribution of form*: Afghanistan, Caucasus, Greece, *alibi.*

**Plantago lanceolata** L. **forma longe-cylindrica** Blatter.

*Spicae angustae, cylindricae, 3.5 cm. longae; pedunculi foliis triplo longiores.*

*Vernacular name*: Khatakai (Waziri).

*Locality*: *N.W.*: N. of Miram Shah village, on clay banks of irrigation channel, 3,150 ft. (B. & F. 465 !, F. 852 !).—Razani (F. 2183 !).—Datta Khel Fort, in garden along water channel, 4,600 ft. (B. & F. 1401 !).

*Flowers & Fruit*: 28-3-30 (Miram Shah); 16-4-27 (Miram Shah); 17-4-30 (Datta Khel); 23-4-27 (Razani); 18-5-27 (Sararogha).

**Plantago lanceolata** L. **forma lagopiformis** Blatter.

*Habet habitum vegetativum Pl. lagopi.*

*Vernacular name*: Zundunh, Khatakai (Waziri).

*Locality*: *N.W.*: Datta Khel Fort, under trees (B. & F. 591 !).—Above Chasmai River, in cultivation (B. & F. 339 !).—Boya (F. 999 !).

*S.W.*: W. of Razmak, on gravel plain, 6,800 ft. (B. & F. 1729 !).—Razmak (F. 2303 ! 3164 !).

*Flowers*: 24-3-30 (Chasmai River); 28-3-27 (Boya); 30-3-30 (Datta Khel); 24-4-30 (Razmak); 5-5-27 (Razmak).

**Plantago lanceolata** L. **forma brevifolia** Blatter.

*Folia multo breviora et angustiora, spicae ovatae vel oblongae.*

*Vernacular name*: Pevra (Waziri).

*Locality*: *N.W.*: Bed of Tochi River at Miram Shah village, on gravel and sand, 3,150 ft. (B. & F. 510 !).—Datta Khel village, on clay bank of water channel, 4,600 ft. (B. & F. 1495 !, F. 1277 ! 1309 !).—Razani (F. 2620 !).

*Flowers*: 25-3-27 (Datta Khel); 28-3-30 (Tochi River); 17-4-30 (Datta Khel); 25-4-27 (Razani).

**Plantago lusitanica** Willd. Sp. Pl. i, 644; Dcne. in Dc. Prodr. xiii (1852), pt. 1, 716.—*P. Lagopus* L. *var. major* Boiss. Fl. Or. iv, 886.—*P. lagopus* L. *var. lusitanica* Muschler Fl. Egypt ii, 910.

Boiss. 1.c has put *P. lusitanica* Willd. as a variety under *P. Lagopus* L. and Muschler has followed him. I think this was an oversight, as will be clear to everybody who carefully reads the descriptions in Decaisne (DC. Prodr. l.c.). Our specimen shows the leaves 5-7-nerved.

*Locality*: *N.W.*: Razani (F. 2209 ! 2833 !).

*S.W.*: N. of Razmak below Springs, 7,700 ft. (B. & F. 1256 ! 1823 !).—Slope of Shuidar, in meadow, 7,500-8,000 ft., together with *Rumex* (F. 1583 !).

*Flowers*: 14-4-30 (Razmak); 18-4-30 (Shuidar); 19-4-27 (Razani); 23-4-27 (Razani); 25-4-30 (Razmak).

*Distribution*: Mesopotamia, Syria, Mediterranean.

**Plantago major** L. Sp. Pl. 112.

*Vernacular name*: Gozi.

*Locality*: *S.W.*: Near Kaniguram brook (Stewart).—Pre Ghal (J. Williams 7910 !).

*Flowers*: 2-8-1888 (Pre Ghal); September 1860 (Kaniguram).

*Distribution*: Temperate and alpine Himalaya up to 12,000 ft., Konkan, Deccan, Nilgiris, Ceylon, Assam, Khasia Hills, Burma, Malay Peninsula, Afghanistan, westwards to the Atlantic.

**Plantago major var. brevis** Pilger.

*Locality*: *Tank*: Near Tank (J. Williams 9225 !).

*Fruit*: 30-7-1888 (Tank).

## NYCTAGINACEAE.

160 species.—Mostly tropical and especially American.

BOERHAVIA Vaill. ex L.

40 species.—Cosmopolitan.

**Boerhavia diffusa** L. Sp. Pl. (1753) 3.—*B. procumbens* Roxb. Fl. Ind. i (1832) 146.
*Vernacular name*: Sussasir.
*Locality*: *N.W.*: Razani (Stewart).—Miram Shah, open stony plain (F. 327 ! 462 !).—Miram Shah, Tochi River (F. 361 !).—Khajuri Post, left bank of Sua Algad, 2,250 ft. (B. & F. 392 !).—E. of Spinwam Fort, nearest sandstone ridge, 2,800 ft. (B. & F. 780 !).—W. of Spinwam Fort, gravel plain, 2,650 ft. (B. & F. 855 !).
*S.W.*: Near Palosina (Stewart).—Razmak, stony plain (F. 2649 !).—Spin (F. 3536 !).
*Tank*: (J. Williams 7190 !).
*Flowers & Fruit*: 26-3-30 (Khajuri); April 1860 (Palosina, Razani); 4-5-1888 (Tank).
*Distribution*: Throughout India, Ceylon, tropical and subtropical Asia, Africa and America.

**Boerhavia verticillata** Poir. Encycl. Méth. v (1804) 56.
*Locality*: *N.W.*: W. of Spinwam Fort, gravel plain, 2,650 ft. (B. & F. 834 !).
*Flowers*: 4-4-30 (Spinwam Fort).
*Distribution*: Punjab, W. Peninsula, Baluchistan, Afghanistan, to Syria and tropical Africa.

**Boerhavia repanda** Willd. Sp. Pl. i (1797) 22.
*Locality*: *S.W.*: Sararogha, dry nalas (F. 6 ! 227 ! 611 !).—Jandola, open stony ground and nalas (F. 625 ! 632 !).—Along Tank River (F. 728 !). —Spin (F. 3534 !).
*Flowers & Fruit*: 21-5-27 (Sararogha); 21-6-27 (Spin).
*Distribution*: Baluchistan, Upper Gangetic plain and Rohilkhand, Konkan, Mysore, Travancore, Carnatic, Burma.

## ILLECEBRACEAE.

About 70 species.—Most warm dry regions.

HERNIARIA (Tourn.) L.

20 species.—Mediterranean, Europe, S. Africa.

**Herniaria hirsuta** L. Sp. Pl. 218.
*Vernacular name*: Meravarki.
*Locality*: *Tank*: Near Tank, Shaur Hill (J. Williams !).
*Flowers*: 31-4-1891 (Tank).
*Distribution*: W. Himalaya, 4,000-8,000 ft., Punjab, Orient, westwards to the Atlantic.

COMETES L.

2 species.—W. Asia, Abyssinia.

**Cometes surattensis** Burm. Fl. Ind. 39, t. 15, f. 5.
*Locality*: Waziristan (ex Annendale & Carter p. 286).
*Distribution*: Sind, Baluchistan, Orient to S. Arabia.

## AMARANTACEAE

700 species.—Tropical and temperate regions.

AMARANTHUS L.

60 species.—Tropical and temperate regions.

* **Amaranthus Blitum** L. **var. oleracea** Hook. f. Fl. Brit. Ind. iv (1885) 721.
*Locality*: *N.W.*: Miram Shah, in garden (B. & F. 636 !),

14. Looking W.N.W. from the hill-range E. of Miram Shah Fort with Afghan hills in the distance.

15. Lower slopes of Choṭa Darweshta W. of Spinwam Fort. Huge boulders with gravel.

*Photos by J. Fernandez.*

*Flowers*: 31-3-30 (Miram Shah).
*Distribution*: Cultivated in India and elsewhere in warm regions.

**Amaranthus paniculatus** L. Sp. Pl. ed. ii, 1406.
*Vernacular name*: Darvadhang (Waziri).
*Locality*: *S.W.*: Slope of Shuidar, in terrassed field, 7,000-9,000 ft., plant of previous year (F. 1575 !).—Razmak (F. 2517 ! 2519 !).
*Distribution*: Cultivated or an escape in E. and W. Asia and Africa.

**Amaranthus viridis** L. Sp. Pl. (1753) 1405.
*Locality*: *N.W.*: Miram Shah, in garden (B. & F. 641 !).
*Flowers & Fruit*: 31-3-30 (Miram Shah).
*Distribution*: All tropical countries.

### PUPALIA Juss.

7 species.—Africa, Madagascar, Asia.

**Pupalia lappacea** Moq. in DC. Prodr. xiii, 2, 331.
*Locality*: *N.W.*: In the plains (Stewart).
*Tank*: Near Tank (J. Williams 7912 !).
*Flowers*: 25-6-1888 (Tank).
*Distribution*: W. tropical Himalaya, 1,000-3,000 ft., from Kashmir to Kumaon, Punjab, Deccan, tropical Asia and Africa.

### AERUA Forsk.

12 species.—Tropical Asia, Africa.

**Aerua tomentosa** Forsk. Fl. Aeg.-Arab. (1775) n. 584, *et* p. 170.—*A. javanica* Juss. in Ann. Mus. Par. ii (1803) 131.
*Vernacular name*: Ganderai, Khadavana (Waziri).
*Locality*: *N.W.*: Dwa Warkha (Stewart).—Slope of Chota Darweshta, W. of Spinwam Fort, 2,700-3,000 ft. (B. & F. 716 !).—Miram Shah (F. 943 ! 987 ! 990 !).—E. of Spinwam Fort, nearest sandstone ridge, 2,800 ft. (B. & F. 778 !).
*S.W.*: Nilikach, Gomal Pass (Duthie's Collect. 15736 !).—Sararogha (F. 45 ! 59 ! 80 !).—Jandola (F. 261 ! 4138 !), along Tank River (F. 693 ! 707 ! 716 ! 4107 !).—Sarwekai (F. 3997 ! 4005 !).—Tenai Post (F. 3793 !).—Tenai, on stony plain (F. 3813 !).
*Tank*: (Stewart, J. Williams 7192 !).
*In bud*: 21-6-27 (Tenai).
*Flowers & Fruit*: 13-4-27 (Miram Shah); April 1860 (Tank); 1-5-1888 (Tank); 18-5-27 (Sararogha); 27-5-27 (Jandola); 8-6-27 (Sarwekai).
*Fruit*: 23-5-1895 (Gomal Pass).
*Distribution*: India, Ceylon, Arabia, tropical Africa, Cape de Verde Islands.

**Aerua tomentosa** Forsk. **var. Bovei** (Webb) C. B. Clarke in Fl. Trop. Afr. vi, 1 (1909) 38.—*A. javanica var. Bovei* Webb in Boiss. Fl. Or. iv, 993.
*Vernacular name*: Spinkhadai (Waziri).
*Locality*: *N.W.*: Spinwam, on stony ground at foot of hill to the E., 2,600 ft. (B. & F. 759 !).
*Distribution*: Afghanistan, Baluchistan, Arabia, Egypt.

**Aerua pseudo-tomentosa** Blatter & Hall. in Journ. Bomb. Nat. Hist. Soc. xxvi (1919) 817.
*Locality*: *N.W.*: N. of Spinwam Fort on desintegrating limestone hill, 2,650 ft. (B. & F. 826 !).—Near Khajuri, slope of ridge along left bank of Sua Algad, 2,250 ft. (B. & F. 386 !).
*Flowers*: 26-3-30 (Khajuri); 4-4-30 (Spinwam).
*Distribution*: Jodhpur and Jaisalmer States.

**Aerua lanata** Juss. in Ann. Mus. Par. ii (1803) 131.
*Vernacular name*: Kharbita.
*Locality*: *N.W.*: E. of Spinwam Fort, on hill, 2,900 ft., fairly common (B. & F. 777 !).—N. of Spinwam, on limestone hill, 2,650 ft. (B. & F. 830 ! 831 !).—Miram Shah (F. 341 ! 348 ! 354 ! 949 !).
*S.W.*: Spin, open stony plain (F. 3530 ! 3829 ! 3855 ! 3870 !).

*In bud*: 3-4-30 (Spinwam); 16-4-27 (Miram Shah).
*Flowers & Fruit*: 21-6-27 (Spin).
*Distribution*: Throughout India, Ceylon, Baluchistan, Arabia, tropical Africa, Java, Philippines.

### ACHYRANTHES L.

15 species.—Tropics and subtropics.

**Achyranthes aspera** L. Sp. Pl. (1753) 204.
*Vernacular name*: Uput kanda (Williams).
*Locality*: *N.W.*: Dwa Warkha (Stewart).
*S.W.*: Sararogha (F. 235 !).—Jandola, along dry banks of Tank River (F. 777 !).
*Tank*: (J. Williams 7194 !).
*Flowers*: 4-5-1888 (Tank); 21-5-27 (Sararogha); 25-5-27 (Jandola); Oct. 1860 (Dwa Warkha).
*Distribution*: Tropics generally.
*Uses*: Flowers used as a cathartic in children (Williams).

## CHENOPODIACEAE.

500 species.—Natives of all climates as nearly all are halophytic.

### CHENOPODIUM (Tourn.) L.

60 species.—All climates.

**Chenopodium album** L. Sp. Pl. (1753) 219.
*Vernacular name*: Ganar, Surmai (Waziri).
*Locality*: *N.W.*: Dwa Warkha (Stewart).—Near Datta Khel along irrigation channel, 4,600 ft. (B. & F. 1440 !).—Datta Khel village, nala, 4,600 ft. (B. & F. 1356 ! 1411 ! 1412 ! 1489 !).—Near Miram Shah village, bed of Tochi River, in gravel and sand (B. & F. 493 !).—E. of Miram Shah, sandy plain, 3,150 ft. (B. & F. 132 !).—Near Miram Shah, right bank of Chasmai River (B. & F. 288 !).—Spinwam Fort, 2,650 ft. (B. & F. 440 ! 666 ! 790 ! 865 !).—Dossali Fort, 4,900 ft. (B. & F. 1301 !).
*S.W.*: N. of Razmak, 7,700 ft. (B. & F. 1848 !).—Sararogha, 5,000 ft. (F. 140 ! 616 !).—Wana (F. 3431 !).
*Tank*: (J. Williams 7195 !).
*Flowers*: 27-3-30 (Spinwam); 28-3-30 (Miram Shah village); 17-4-30 (Datta Khel); 4-5-1888 (Tank).
*Distribution*: Tropical and temperate Himalaya, from Kashmir to Sikkim up to 14,000 ft., Punjab, Baluchistan, cosmopolitan.

**Chenopodium opulifolium** Schrad. in DC. Fl. Franc. 5 (1805) 372.
*Locality*: *N.W.*: Dossali Fort, left bank of Khaisora River, 4,900 ft. (B. & F. 1160 ! 1167 !).
*Flowers & Fruit*: 13-4-30 (Dossali Fort).
*Distribution*: Central and W. Himalaya, N. and W. Asia, Europe, Mediterranean.

**Chenopodium hybridum** L. Sp. Pl. (1753) 219.
*Locality*: *N.W.*: Dwa Warkha (Stewart).
*Distribution*: W. Himalaya, 12,000 ft., Punjab, Baluchistan, Europe, N. Africa, N. Asia.

**Chenopodium murale** L. Sp. Pl. (1753) 219.
*Vernacular name*: Thormai (Waziri).
*Locality*: *N.W.*: Hills E. of Miram Shah Fort (B. & F. 560 !).—Miram Shah, garden, 3,150 ft. (B. & F. 639 !); Right bank of Chasmai River, 3,100 ft. (B. & F. 232 !).—Near Khajuri Post, bed of Sua Algad, 2,250 ft. (B. & F. 362 !).—W. of Spinwam Fort, 2,650 ft. (B. & F. 755 ! 857 !).
*Flowers & Fruit*: 29-3-30 (Miram Shah); 4-4-30 (Spinwam).
*Distribution*: Ubiquitous.

**Chenopodium botrys** L. Sp. Pl. (1753) 219.
*Locality*: *N.W.*: Boya, 3,550 ft. (B. & F. 1679 !).

*S.W.*: Pre Ghal (Hay, J. Williams 7913 !).—N. of Doboi, above 5,000 ft. on a feeder of the Zam, abundant (Stewart).—Kundiwan, 5,500 ft. (Duthie's Collect. 157633 !).
*Flowers*: 21-4-30 (Boya); May 1860 (Kundiwan); 10-5-1895 (Kundiwan).
*Distribution*: W. Himalaya, 4,000-14,000 ft., Punjab, Orient, N. Africa.

**Chenopodium foliosum** (Moench.) Aschers. Fl. Prov. Brandenb. (1864) 572.—*Blitum virgatum* L. Sp. Pl. (1753) 4.
*Vernacular name*: Towe (Waziri).
*Locality*: *N.W.*: Razmak Narai, 7,250 ft. (B. & F. 1192 !).
*S.W.*: E. of Razmak, slope of hill, 6,800 ft. (B. & F. 1927 !).—Razmak (F. 2286).—Between Makin and Razmak (Stewart).
*Tank*: (J. Williams 9179 !).
*Flowers & Fruit*: 25-4-30 (Razmak); 7-5-27 (Razmak); 1-7-1888 (Tank).
*Distribution*: N.W. India, Turkestan, Siberia, Orient, Europe, N. Africa.

**Chenopodium rubrum** L. Sp. Pl. (1753) 218.—*Blitum polymorphum* C. A. Mey. in Led. Fl. Alt. i (1826) 13.
*Locality*: *N.W.*: Miram Shah Fort, garden, 3,150 ft. (B. & F. 626 !).
*S.W.*: S.W. of Razmak, 6,950 ft. (B. & F. 1935 !).
*Flowers & Fruit*: 31-3-30 (Miram Shah); 27-4-30 (Razmak).
*Distribution*: Siberia, Turkestan, Orient, Europe.

### *SPINACIA (Tourn.) L.

2 species.—E. Mediterranean.

* **Spinacia oleracea** L. Sp. Pl. (1753) 1027.
*Locality*: *N.W.*: Miram Shah village, 3,150 ft., cultivated (B. & F. 491 !).
*Flowers & Fruit*: 28-3-30.
*Distribution*: Cultivated everywhere.

### ATRIPLEX (Tourn.) L.

180 species.—Temperate and subtropical regions.

**Atriplex crassifolia** C. A. Mey. in Led. Fl. Alt. iv, 309.
*Locality*: *N.W.*: Khaisora (Stewart).—Near Khajuri Post, right bank of Sua Algad, 2,250 ft. (B. & F. 358 !).
*Distribution*: N. W. India and the Punjab, 8,000-12,000 ft., Afghanistan, Turkestan, Soongaria, Altai Mts.

**Atriplex Stocksii** Boiss. Diagn. ser. ii, no. 4 (1859) 73.
*Locality*: *N.W.*: E. of Spinwam Fort, sandstone nala, 2,650 ft. (B. & F. 681 !).
*Distribution*: Gujarat, Kathiawar, Sind.

**Atriplex hastata** L. Sp. Pl. (1753) 1053.
*Vernacular name*: Vorogo titkai (Waziri).
*Locality*: *S.W.*: E. of Razmak Camp, 6,800 ft. (B. & F. 1737 ! 1903 !, F. 2404 !).
*Flowers & Fruit*: 2-5-27 (Razmak); 25-4-30 (Razmak).
*Distribution*: Siberia, Afghanistan, Orient, Mediterranean, Europe.

**Atriplex Belangeri** Moq. in DC. Prodr. xiii, 108.
*Locality*: *N.W.*: Miram Shah village, old torrent bed, 3,150 ft. (B. & F. 513 !).—Plain W. of Spinwam Fort, 2,650 ft. (B. & F. 866 !).
*Distribution*: Afghanistan, Persia.

**Atriplex farinosa** Forsk. Fl. Aeg.-Arab. (1775) cxxiii, no. 302.
*Locality*: *S.W.*: Wana, common, 5,000 ft. (F. 3465 !).
*Flowers*: 16-6-27 (Wana).
*Distribution*: Brit. E. Africa, Nubia, Egypt, Arabia, Petraea, tropical Arabia.

**Atriplex affinis leucoclado** Boiss.
*Locality*: *S.W.*: Sarwekai (F. 3900 !).—Spin, open stony plain (F. 3859 !).

### EUROTIA Adans.

2 species.—Mediterranean, W. Asia, N. America.

**Eurotia ceratoides** (L.) C. A. Mey. in Led. Fl. Alt. iv (1833) 239.—*Axyris ceratoides* L. Sp. Pl. (1753) 979.
*Locality*: *N.W.*: Khajuri Post, right bank of Sua Algad, on gravel, 2,250 ft. (B. & F. 350 !).
*Distribution*: W. Himalaya, 8,000-14,000 ft., Central Asia, Siberia, Mongolia, Afghanistan, Europe, Mediterranean.

### KOCHIA Roth.

35 species.—N. temperate regions, Australia, S. Africa.

**Kochia prostrata** (L.) Schrad. Neues Journ. iii, 3, 4 (1809) 85.
*Locality*: *N.W.*: E. of Datta Khel Fort, stony plain, 4,600 ft. (B. & F. 1375 !).
*S.W.*: Spin, open stony plain (F. 3843 !).—Wana, 5,000 ft. (F. 3499 !).
*Distribution*: W. Himalaya, 10,000-14,000 ft., Central Asia, Siberia, westwards to Spain and N. Africa.

**Kochia stellaris** Moq.-Tand. Chenop. Monogr. Enum. (1840) 93.—*K. odontoptera* Schrenk. in Bull. Acad. Petersb. i (1843) 361.
*Locality*: Lower zone (Stewart).
*Distribution*: W. Tibet, 8,000-12,000 ft., Afghanistan, Baluchistan, Turkestan, Persia.

### SUAEDA Forsk.

40 species.—Cosmopolitan, on seacoast and in salt steppes.

**Suaeda fruticosa** Forsk. Fl. Aeg.-Arab. (1775) 70.
*Vernacular name*: Kali sauri (Williams).
*Locality*: *N.W.*: Khajuri Post, left bank of Tochi River, 2,250 ft. (B. & F. 415 !).
*Tank*: (J. Williams 7198 !).
*Flowers*: 26-3-30 (Khajuri); 4-5-1888 (Tank).
*Distribution*: N.W. India, westwards to the Atlantic, Africa, America.
*Uses*: Camels eat it.

**Suaeda monoica** Forsk. Fl. Aeg.-Arab. (1775) 70.
*Locality*: *N.W.*: Khajuri Post, right bank of Sua Algad, on gravel, 2,250 ft. (B. & F. 349 !).
*S.W.*: Jandola (F. 3890 !).—Dargai Post (F. 3765 !).—Tenai (F. 4020 !).—Spin, open stony plain (F. 3541 ! 3835 !).
*Distribution*: S. India, Ceylon, Baluchistan, Arabia, tropical Africa.

**Suaeda maritima** (L.) Dumort. Fl. Belg. (1827) 22.—*Chenopodium maritimum* L. Sp. Pl. (1753) 221.
*Locality*: *S.W.*: Dargai Post (F. 3775 !).—Tenai (F. 4038 !).
*Distribution*: India, Ceylon, Siam, N. Asia, Orient, N. Africa, Europe, N. America.

**Suaeda sp.**
*Locality*: Waziristan (Duthie's Collect. 15730).

### HALOXYLON Bunge.

10 species.—Mediterranean, Central Asia.

**Haloxylon recurvum** Bunge ex Boiss. Fl. Or. iv (1879) 949.
*Locality*: *N.W.*: 9 miles S. of Spinwam Fort (B. & F. 692 !).
*S.W.*: Spin, open stony plain (F. 3851 ! 3860 ! 3861 !).
*Distribution*: India, Afghanistan, Baluchistan, Yunnan.

**Haloxylon salicornicum** Bunge ex Boiss. Fl. Or. iv (1879) 949.
*Vernacular name*: Shurai, Karsussa, Nunai (Waziri).
*Locality*: *N.W.*: Datta Khel Fort, 4,500 ft. (B. & F. 608 !).—Plain N. of Boya Fort, clayey sand, 3,550 ft. (B. & F. 74 !).—Plain E. of Miram

Shah Fort, gravel, also in water, 3,150 ft. (B. & F. 121 ! 129 ! 149 ! 484 !, F. 479 !).—Spinwam, hills, 2,650 ft. (B. & F. 763 !).

*S.W.*: Razmak (F. 1639 !).—Sarwekai (F. 3957 ! 3974 !).—Tenai Post (F. 3808 !).

*Distribution*: Punjab, Baluchistan, Afghanistan.

**Haloxylon articulatum** Boiss. Fl. Or. iv (1879) 949.

*Vernacular name*: Sherai (Waziri).

*Locality*: *N.W.*: Near Miram Shah Fort, right bank of Chasmai River, 3,100 ft. (B. & F. 234 !).

*Distribution*: Syria, tropical Arabia N. Africa, Mediterranean.

**Haloxylon multiflorum** Bunge in Boiss. Fl. Or. iv (1879) 949.

*Vernacular name*: Uch sarakai (Waziri), Sherakai (at Boya), Shurai (at Wana).

*Locality*: *N.W.*: Dwa Warkha (Stewart).—Datta Khel (F. 1182 !).—Boya, gravel (B. & F. 1481 ! 1671 !).—Miram Shah, open stony ground (F. 434 !).

*S.W.*: Wana, open stony ground (F. 3615 !).

*Distribution*: Afghanistan.

**Haloxylon Griffithii** Boiss. Fl. Or. iv (1879) 950.

*Vernacular name*: Sherai (Madda Khel and Khaddar Khel, Waziri), Shorai (by the Ahmadzai Waziri), Galmai (Waziri).

*Locality*: *N.W.*: Khaisora River (Stewart).—Datta Khel, 4,500 ft. (J. A. Robinson !).—Miram Shah (F. 817 !).

*S.W.*: Sarwekai (F. 3898 ! 3922 ! 3970 !).

*Fruit*: 3-11-29 (Datta Khel).

*Distribution*: Baluchistan, Afghanistan.

### SALSOLA L.

40 species.—Cosmopolitan, maritime or on salt steppes.

**Salsola Kali** L. Sp. Pl. (1753) 222.

*Locality*: *N.W.*: In the lower regions (Stewart).

*S.W.*: Tenai Post, common on stony plain (F. 3792 ! 3795 !).—Spin, open stony plain (F. 3832 !).

*Distribution*: N.W. Punjab and Himalaya, 12,000-14,000 ft., westwards to the Atlantic, N. Asia, N. & S. Africa, N. America.

**Salsola collina** C. A. Mey. in Led. Fl. Alt. i, 393.

*Locality*: *N.W.*: Datta Khel Fort, 4,600 ft., specimen of previous year collected 17-4-30 (B. & F. 1410 !).

*Distribution*: Western Himalaya, 12,000-15,000 ft., Siberia, Soongaria, S. Russia.

**Salsola foetida** Del. Fl. d'Egypt (1813) 57.

*Locality*: *N.W.*: In the lower regions (Stewart).—Khajuri Post, hill on left bank of Sua Algad, 2,300 ft. (B. & F. 355 ! 381 ! 382 !).

*S.W.*: Jandola, open stony plain (F. 3897 !).—Dargai Post, stony slope (F. 3727 ! 4086 !).—Tenai (F. 4019 !).—Spin, open stony plain, common (F. 3542 ! 3849 !).

*Distribution*: Punjab Plains, Upper Gangetic Plain, Sind, Rajputana Desert, Baluchistan, Persia, Arabia, Africa.

**Salsola verrucosa** M. B. in Mem. Soc. Nat. Mosc. i (1811) 103.—*S. ericoides* C. A. Mey. Ind. Cauc. 160 (*non* M.B.).

*Locality*: *N.W.*: S. of Spinwam Fort, gravel plain (B. & F. 689 !).

*S.W.*: Spin, open stony plain (F. 3848 !).

*Fruit*: 1-4-30, of previous year (Spinwam).

*Distribution*: Persia, Orient, S.E. Russia.

**Salsola tetrandra** Forsk. Fl. Aeg.-Arab. (1775) 58.—*S. tetragona* Del. Fl. d'Eg. (1813) 204, tab. 22.

*Locality*: *N.W.*: S. of Spinwam Fort (B. & F. 691a !).

*Distribution*: Palestine, Arabia Petraea, Egypt, N. Africa.

### ANABASIS L.

20 species.—Mediterranean, Central Asia.

**Anabasis phyllophora** Kar. & Kir. Enum. Alt. (1841) no. 735.
*Locality*: *N.W.*: S. of Spinwam Fort (B. & F. 691 !).
*Distribution*: Punjab, Turkestan, Soongaria, Altai.

**Anabasis setifera** Moq. in Chenop. Enum. 164 *et* DC. Prodr. xiii, 2, 214.
*Locality*: *N.W.*: Khajuri Post, hill on left bank of Sua Algad, 2,450 ft. (B. & F. 396 !).
*Distribution*: Punjab, Salt Range, Persia, Arabia, Egypt.

### HALOCHARIS Moq.

4 species.—W. Asia.

**Halocharis violacea** Bunge Anabas. Rev. 63, t. 1, f. 3.
*Locality*: *N.W.*: Dwa Warkha (Stewart).
*Distribution*: Punjab, Salt Range, Peshawar valley, Baluchistan, Afghanistan, S.E. Persia.

### HALOGETON C. A. Mey.

5 species.—Mediterranean, Central Asia.

**Halogeton glomeratus** (M.B.) C. A. Mey. in Led. Fl. Alt. i (1829) 378.
*Locality*: *N.W.*: Datta Khel, garden, 4,600 ft. (B. & F. 1396 !).
*Distribution*: W. Tibet, 12,000-14,000 ft., Afghanistan, Turkestan, Siberia, Soongaria.

## POLYGONACEAE.

750 species.—Chiefly N. temperate; a few tropical, arctic and southern.

### CALLIGONUM L.

20 species.—N. Africa, W. Asia, S. Europe.

**Calligonum polygonoides** L. Sp. Pl. (1753) 530.
*Locality*: *Tank*: (J. Williams 7204 !).
*Flowers*: 5-5-1888 (Tank).
*Distribution*: Punjab, Salt Range, Baluchistan, Orient.

### POLYGONUM (Tourn.) L.

275 species.—Cosmopolitan, but especially temperate.

**Polygonum barbatum** L. Sp. Pl. (1753) 362.
*Locality*: *N.W.*: Razani (Stewart).
*Distribution*: Throughout the tropics.

**Polygonum plebejum** Br. Prodr. 420.
*Vernacular name*: Chiradha.
*Locality*: *Tank* (J. Williams 7201 !).
*Flowers*: 4-5-1888 (Tank).
*Distribution*: Afghanistan, tropics of the Old World.

**Polygonum aviculare** L. Sp. Pl. (1753) 362.
*Locality*: *S.W.*: In the lower regions (Stewart).—Kaniguram, about 6,500 ft. (Stewart).
*Tank*: (J. Williams 7916 ! Stewart).
*Flowers*: April 1860 (Tank, Kaniguram); 21-6-1888 (Tank).
*Distribution*: Widely dispersed, indigenous in Europe and N. Asia.

**Polygonum paronychioides** C. A. Mey. in Bull. Soc. Nat. Mosc. (1898) 356; Meissn. in DC. Prodr. xiv, 1.—*P. Paronychia* C. A. Mey. Ind. cauc. 158 (*non* Cham. *et* Schlecht).
*Locality*: Tank (Duthie's Collect. 15634 !).
*Flowers*: 29-4-1895 (Tank).
*Distribution*: W. Himalaya, 8,000-12,000 ft., Afghanistan, Persia.

**Polygonum baldschuanicum** Regel in Act. Hort. Petrop. viii (1884) 684, t. 10.
*Locality*: *S.W.*: Razmak, in garden (B. & F.).
*Distribution*: Bokhara.

**Polygonum flaccidum** Meissn. in DC. Prodr. xiv, 107 (*partim*).
*Locality*: *S.W.*: In the upper regions (Stewart).
*Distribution*: Common throughout India in wet places, Ceylon, Malacca, Malay Archipelago.

**Polygonum sp.**
*Locality*: Waziristan (Duthie's Collect. 15733).

### RUMEX L.

100 species.—Especially N. temperate.

**Rumex maritimus** L. Sp. Pl. (1753) 335.—*R. acutus* Roxb. Fl. Ind. ii, 208.
*Locality*: Tank (Stewart).
*Flowers*: April 1860 (Tank).
*Distribution*: Marshes in Assam, Sylhet, Cachar and Bengal, Asia, Europe, N. Africa, S. America.

**Rumex dentatus** L. Mant. 226.
*Vernacular name*: Lablaba (Williams).
*Locality*: *S.W.*: Kaniguram, 6,500 ft. (Duthie's Collect. 15767 !).
*Tank* (J. Williams 7203 !).
*Flowers*: 13-5-1895 (Kaniguram); 14-5-1888 (Tank).
*Distribution*: N. India, Baluchistan, Afghanistan, Orient, Egypt.

**Rumex dentatus** L. Mant. 226, **var. pleiodon** Boiss. Fl. Or. iv, 1013.
*Locality*: *N.W.*: In garden at Miram Shah, 3,150 ft. (B. & F. 635 !).
*Flowers*: 31-3-30 (Miram Shah).

**Rumex vesicarius** L. Sp. Pl. (1753) 479.
*Locality*: *S.W.*: Near Palosina (Stewart).
*Distribution*: W. Punjab, Baluchistan, Afghanistan, Persia, the Levant, N. Africa.

## LAURACEAE.

1,000 species.—Tropical and subtropical regions.

### CASSYTHA L.

15 species.—Palaeotropics.

**Cassytha filiformis** L. Sp. Pl. (1753) 35.
*Locality*: *S.W.*: Razmak, riverbed, on *Berberis*, 6,750 ft. (B. & F. 54 !).
*Flowers*: 20-3-30 (Razmak).
*Distribution*: Tropics generally.

## THYMELAEACEAE.

550 species.—Temperate regions and tropics, especially in Africa.

### DAPHNE Tourn. ex L.

40 species.—Europe, temperate and subtropical Asia.

**Daphne oleoides** Schreb. Ic. Descr. Pl. Decad. i (1766) 13, t. 7; Brandis Ind. Trees (1911) 544; Parker For. Fl. Punj. (1918) 432.—*D. mucronata* Royle Ill. 322, t. 81, fig. 2; Brandis For. Fl. (1874) 384.—*D. acuminata* Boiss. & Hoh. Diagn. ser. 1, xii, 103; Boiss. Fl. Or. iv (1879) 1048.
*Vernacular name*: Laghinai, Pastavana (Waziri).
*Locality*: *N.W.*: Boya, on hills, S. of Boya Post, about 4,300 ft. (F. 1463 ! 1492 ! 1493 ! 1494 ! 1495 ! 1496 !).—Miram Shah, on hills, about 3,200 ft. (F. 1388 ! 1391 ! 1403 ! 1408 !).—Razani, common on hills, about 5,200 ft. (F. 2051 ! 2777 ! 2890 !).—Near Datta Khel (B. & F. 597 !).—Near Spinwam, Chota Darweshta, 4,800 ft. (B. & F. 737 !).—Dossali, stony plain, 4,900 ft. (B. & F. 998 ! 999 ! 1021 !).

*S.W.*: Pre Ghal (Hay).—Above Anai Gorge, about 4,000 ft. (Stewart).—On wide shingle plateau of Tandachina (Stewart).—Razmak, open stony plain and on hills, 6,500 ft. (F. 1535 ! 1536 ! 1537 ! 1833 ! 2000 ! 2002 ! 2250 ! 2263 ! 2653 ! 2675 ! 2699 ! 2701 ! 2723 ! 2724 ! 2725 ! 3317 !).—Wana, scattered on plain, 4,500 ft. (F. 3454 ! 3461 !).—Barwand (Duthie's Collect. 15725 !).—Shuidar, 7,000-9,000 ft. (F. 1591 !).

*Flowers*: 30-3-30 (Datta Khel); 10-4-30 (Dossali); June.

*Distribution*: Mediterranean region, W. Asia, Afghanistan, Baluchistan, Kuram Valley to 11,000 ft., Himalaya as far east as the Jumna, 3,000-9,000 ft., Punjab.

THYMELAEA Tourn. ex Scop.

20 species.—Mediterranean, temperate Asia.

**Thymelaea passerina** (L.) Coss. *et* Germ. ex Fedtschenko *et* Fedtschenko Consp. Fl. Turk. vi (1916) 296.—*Stellera passerina* L. Sp. Pl. (1753) 559.—*Thymelaea arvensis* Lam. Fl. Fr. iii, 218.

*Locality*: *S.W.*: Lower regions (Stewart).

*Flowers*: April.

*Distribution*: Upper Punjab, Kashmir, Afghanistan, westwards to France and N. Africa.

## ELAEAGNACEAE.

25 species.—Chiefly on steppes and coasts of N. hemispheres.

ELAEAGNUS (Tourn.) L.

20 species.—Asia, Europe, N. America.

**Elaeagnus angustifolia** L. Sp. Pl. ed. i (1753) 176; Fedtschenko & Fedtschenko Consp. Fl. Turk. pt. 6 (1916) 298.—*E. spinosa* L. Amoen. Acad. iv, 305.—*E. hortensis* M. Bieb. Fl. Taur.-Cauc. ii (1808) 112; Boiss. Fl. Or. iv (1879) 1056; Servettaz Monogr. des Eléagnacées in Beih. Bot. Centralbl. 2. Abt. xxv (1909) 33.

*Locality*: *N.W.*: Razani, planted, 5,000 ft. (F. 2210 ! 2213 ! 2218 ! 2227 ! 2775 ! 2776 ! 2782 !).—Miram Shah, 3,000 ft. (F. 1078 !).

*S.W.*: Wana, planted, 4,500 ft. (F. 3664 ! 3672 ! 3674 !).—Razmak, 6,500 ft. (F. 2779 !).

**Elaeagnus umbellata** Thunb. Fl. Jap. 66, t. 14; Brandis Ind. Trees (1911) 547; Parker For. Fl. (1918) 434.—*E. parvifolia* Wall. Cat. 4026; Royle Ill. 323, t. 81, f. 1.

*Vernacular name*: Sanzela (Waziri).

*Locality*: *N.W.*: Boya, 4,000 ft. (F. 894 ! 1370 ! 1371 ! 1372 ! 1373 ! 1374 !).—Miram Shah, 3,000 ft. (F. 1085 ! 1086 !, B. & F. 511 !).

*S.W.*: Wana, S.E. of Camp, 4,500 ft. (F. 3602 ! 3634 ! 3675 !). All the specimens from planted trees.

*Flowers*: April.

*Distribution*: Kuram Valley, Himalaya, 3,000-10,000 ft., Manipur, China, Japan.

*Uses*: Fruit eaten.

## LORANTHACEAE.

520 species.—Tropical and temperate regions.

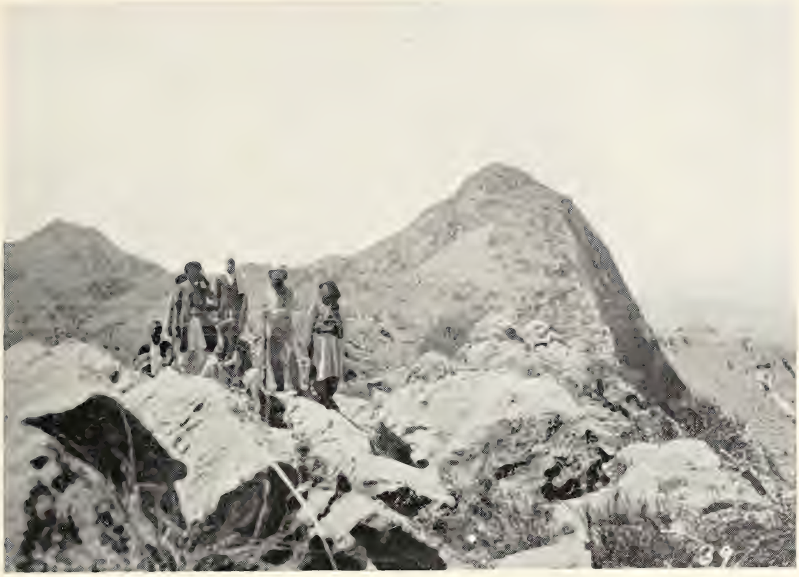
VISCUM Tourn. ex L.

20 species.—Old World.

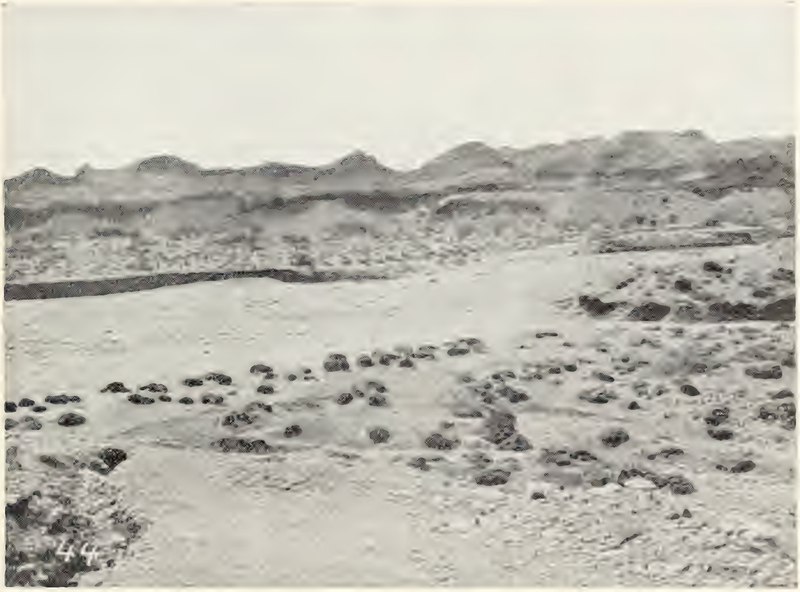
**Viscum album** L. Sp. Pl. (1753) 1023.

*Vernacular name*: Mistletoe, Kazhlavan, Kajhvavan.

*Locality*: *N.W.*: Above Dossali Fort, bed of Khunai River, 5,050 ft., on *Olea cuspidata*, very common (B. & F. 69 ! 1095 ! 1096 !), bed of Khaisora River, 5,050 ft. (B. & F. 70 !).—Razani, on *Quercus ilex*, common (F. 2045 ! 2168 !), on *Olea cuspidata* (F. 2048 !).



16. Peak of Chota Darweshta, W. of Spinwam Fort.



17. View towards S. from Shewa Post. Narai Pal and Volam Rivers join here. Vegetion *Withania coagulans* Dunal, *Capparis decidua* Edgew., *Acacia modesta* Wall.

*Photos by J. Fernandez.*

*S.W.*: Near Kaniguram village, abundant on Oaks (Stewart).—N. of Doboi, about 5,000 ft., on a feeder of the Zam, common on *Quercus* and *Olea europ.* (Stewart).

*Flowers*: 12-4-30 (Dossali Fort).

*Distribution*: Kuram Valley, Drosh, Chitral, W. Himalaya, Kashmir to Nepal, 3,000-9,000 ft., Burma, Afghanistan, Europe, Orient, N. Asia, Japan.

## BUXACEAE.

30 species.—Temperate and tropical regions.

### BUXUS L.

25 species.—Palaeotemperate, West Indies.

**Buxus papilosa** C. K. Schneid. Ill. Handb. Laubholzk. ii (1907) 139.—*B. sempervivens* L. in Fl. Brit. Ind. (*partim*).

*Vernacular name*: Box, Shamshath (Mashudi).

*Locality*: *N.W.*: E. of Miram Shah Fort, on hills, 3,600 ft. (B. & F. 568 !).

*S.W.*: Above Anai Gorge, about 4,000 ft., common (Stewart).—Sararogha (F. 135 ! 137 ! 213 ! 231 !).

*Fruit*: 29-3-30 (Miram Shah); 21-5-27 (Sararogha).

*Distribution*: Outer Himalaya, 2,000-4,000 ft., from the Jhelum westward, Salt Range, Trans-Indus.

## EUPHORBIACEAE.

4,000 species.—Cosmopolitan, except arctic.

### EUPHORBIA L.

750 species.—Chiefly subtropical and warm temperate.

**Euphorbia thymifolia** Burm. Fl. Ind. 2.

*Locality*: *N.W.*: Dwa Warkha (Stewart).

*Distribution*: All hot countries, except Australia.

**Euphorbia Clarkeana** Hook. f. Fl. Brit. Ind. v (1887) 253.

*Locality*: *Tank* (J. Williams 7209 !).

*Flowers*: May 1888 (Tank).

*Distribution*: Punjab, Rajputana, W. Peninsula, Sind.

**Euphorbia pilosa** L. Sp. Pl. (1753) 460.

*Locality*: *S.W.*: Pre Ghal (Hay, Duthie's Collect. 15595 !).

*Flowers*: 17-5-1895 (Pre Ghal).

*Distribution*: W. Himalaya, Soongaria, E. Siberia, westwards to the Atlantic.

**Euphorbia hypericifolia** L. Hort. Cliff. 198.

*Locality*: *N.W.*: Razani (Stewart).

*Tank*: In water (J. Williams 7921 !).

*Flowers*: 1-6-1888 (Tank).

*Distribution*: Throughout tropics of both hemispheres except Australia and the Pacific.

**Euphorbia leptocaula** Boiss. in DC. Prodr. xv, 159.

*Locality*: *N.W.*: Hills E. of Miram Shah Fort, among boulders and sandy soil, 3,600 ft. (B. & F. 556 !).—Miram Shah (F. 402 ! 950 ! 960 !).

*S.W.*: E. of Razmak Camp (B. & F. 1952 !).

*Flowers & Fruit*: 29-3-30 (Miram Shah); 13-4-27 (Miram Shah); 28-4-30 (Razmak).

*Distribution*: S.W. Russia, Caucasus.

**Euphorbia Gerardiana** Jacq. Austr. v, 17.

*Locality*: *N.W.*: Dossali, in nala called Rosh, 4,900 ft. (B. & F. 1293 !).

*Flowers & Fruit*: 15-4-30 (Dossali).

*Distribution*: Europe, Orient.

**Euphorbia indica** Lam. Encycl. ii (1786) 423; Boiss. Fl. Or. iv, 1088.

*Locality*: *S.W.*: Jandola, open stony ground and nalas, 2,270 ft. (F. 640 !).

*Flowers & Fruit*: 24-5-27 (Jandola).
*Distribution*: Egypt, Arabia, tropical Africa.

**Euphorbia granulata** Forsk. Fl. Aeg.-Arab. (1775) 94.
*Locality*: *N.W.*: Khajuri Post, ridge along left bank of Sua Algad, 2,450 ft. (B. & F. 397 !).
*S.W.*: Jandola (F. 271 !).
*Tank* (J. Williams 7208 ! 7922 !).
*Flowers & Fruit*: 26-3-30 (Khajuri Post); 27-5-27 (Jandola); 5-6-1888 (Tank).
*Distribution*: Punjab, Malva, Chota Nagpur, Rajputana, W. Peninsula, Sind, Afghanistan, Arabia, Egypt, Canary Islands.

**Euphorbia turcomanica** Boiss. Cent. Euph. 13.
*Locality*: *N.W.*: Shewa Post, bed of Kuram River (B. & F. 930 !).
*Flowers & Fruit*: 5-4-30 (Shewa Post).
*Distribution*: Mesopotamia, Persia.

**Euphorbia humifusa** Willd. Enum. H. Berol. Suppl. 13.
*Locality*: *S.W.*: Sarwekai, 3,930 ft. (F. 3926 !).—Tenai (F. 4040 !).
*Flowers & Fruit*: 7-6-27 (Sarwekai); 21-6-27 (Tenai).
*Distribution*: Caucasus, Siberia, Japan, Mongolia, China. Adventitious in other places.

**Euphorbia microphylla** Heyne in Roth Nov. Pl. Sp. (1821) 229.
*Locality*: *S.W.*: Wana, on gravel, 4,560 ft. (F. 3576 !).—Jandola, along Tank River, 2,270 ft. (F. 736 ! 4417 !).—Sararogha, 4,000 ft. (F. 236 !).—Sarwekai, 3,930 ft. (F. 4406 !).
*Flowers & Fruit*: 21-5-27 (Sararogha); 26-5-27 (Jandola); 8-6-27 (Sarwekai); 15-6-27 (Wana).
*Distribution*: India, Burma, Java.

**Euphorbia pauciradiata** Blatter in Journ. Bomb. Nat. Hist. Soc. (1933) 483.
*Vernacular name*: Kharbita (Waziri).
*Locality*: *N.W.*: Miram Shah, 3,150 ft. (F. 981 ! 981a ! 982 ! 983 !).—Near Spinwam, on boulder strewn slope of Chota Darweshta, 4,800 ft. (B. & F. 749 !).
*Flowers & Fruit*: 2-4-30 (Spinwam); 13-4-27 (Miram Shah).
*Uses*: The fruit is a favourite food of the Chukor (*Alectoris graeca*).

**Euphorbia helioscopia** L. Sp. Pl. 459.
*Vernacular name*: Sagergotiae (Waziri).
*Locality*: *N.W.*: Miram Shah, in fields along water channels (F. 841 !).—Datta Khel (F. 1247 !).
*S.W.*: Kaniguram (Stewart).—Barwand, 4,000 ft. (Duthie's Collect. 15713 !).
*Tank* (J. Williams 7207 !).
*Flowers*: 25-3-27 (Datta Khel); 16-4-27 (Miram Shah); 26-4-1895 (Barwand); 4-5-1888 (Tank).
*Distribution*: W. Himalaya, Punjab, Afghanistan, westwards to the Atlantic.
*Uses*: Juice used in herpes (Williams).

**Euphorbia helioscopioides** Blatter in Journ. Bomb. Nat. Hist. Soc. (1933) 483.
*Vernacular name*: Chalwar-gotiae, Parparai (Waziri).
*Locality*: *N.W.*: Fields near Datta Khel village, 4,600 ft. (B. & F. 1497 !).—Boya Fort, bed of Tochi River, 3,550 ft. (B. & F. 92 !).—Miram Shah Fort, Chasmai River, in cultivation (B. & F. 343 !).—Datta Khel (F. 1245 ! 1388 !).—Boya, cultivated fields (F. 1174 !).
*S.W.*: Sararogha (F. 92 ! 105 ! 105a !).
*Flowers & Fruit*: 21-3-30 (Boya); 24-3-30 (Chasmai River); 25-3-27 (Datta Khel), 5-4-27 (Boya); 17-4-30 (Datta Khel); 18-5-27 (Sararogha).

**Euphorbia Esula** L. Sp. Pl. (1753) 660.
*Locality*: *N.W.*: Boya (F. 278 !).
*Flowers & Fruit*: 2-4-27 (Boya).
*Distribution*: Europe, Central and S. Europe, Orient, Siberia, China.

**Euphorbia sp.** *affinis E. Buhsei* Boiss. in DC. Prodr. xv, 167.
*Involucri lobi flavi.*
*Locality*: *N.W.*: Near Miram Shah, rocky left bank of Chasmai River (B. & F. 321 !).
*Flowers & Fruit*: 24-3-30.

**Euphorbia sp.** (*Sect. Esulae*).
*Frutex* 80 *cm. altus, virgatus. Caules angulato-striati. Involucri lobi truncati-fimbriati. Glandulae magnae bicornutae.*
*Vernacular name*: Khajhabali (Waziri).
*Locality*: *N.W.*: Miram Shah (F. 1390 !).
*Flowers & Fruit*: 14-4-27.

**Euphorbia sp.** near *E. Szovitsii* F. & M. Index Petrop. i, 27.
*Locality*: *S.W.*: Jandola (F. 4126 !).
*Flowers & Fruit*: 29-5-27 (Jandola).

### ANDRACHNE L.

15 species.—Tropics and subtropics.

**Andrachne telephioides** L. Sp. Pl. 1014.
*Vernacular name*: Menboti (Williams); Saebitae (Waziri).
*Locality*: *N.W.*: Razani (Stewart).—Hills E. of Miram Shah Fort, 3,600 ft. (B. & F. 542 !).—Khajuri Post, right bank of Sua Algad, gravel, 2,250 ft. (B. & F. 360 !).—Gravel plain W. of Spinwam, 2,650 ft. (B. & F. 835 !).—E. of Spinwam Fort, nearest sandstone ridge, 2,800 ft. (B. & F. 786 !).—Near Miram Shah Fort, bed of Chasmai River, gravel and sand, 3,100 ft. (B. & F. 253 ! 312 !).—W. of Miram Shah Fort, gravel plain, 3,150 ft. (B. & F. 616 !).—Miram Shah village, clayey bank of irrigation channel, 3,050 ft. (B. & F. 472 !).—Datta Khel Fort, in garden, 4,600 ft. (B. & F. 1409 !).—Datta Khel village, 4,600 ft. (B. & F. 1444 !).—E. of Datta Khel Fort, stony plain (B. & F. 1358 !).—Dossali Fort, nala, 4,900 ft. (B. & F. 1050 ! 1060 !).
*S.W.*: Barwand (Duthie's Collect. 15640 !).—Wana, open stony plain, 4,560 ft. (F. 3466 ! 3567 !).—Spin (F. 3535 !).—Sarwekai, 3,930 ft. (F. 3913 !).—Tenai, 3,200 ft. (F. 4024 !).
*Tank*: Near Tank, Shaur Hill (J. Williams !).
*Flowers & Fruit*: 26-3-30 (Khajuri); 29-3-30 (Miram Shah); 4-4-30 (Spinwam; 17-4-30 (Datta Khel); 28-4-1895 (Barwand); 31-5-1891 (Tank); 16-6-27 (Wana).
*Distribution*: Punjab, Salt Range, Afghanistan, westwards to the Atlantic.

### PHYLLANTHUS L.

500 species.—Temperate and tropical regions, excluding Europe and N. Asia.

**Phyllanthus debilis** Herb. Ham. ex Wall. Cat. (1828) *sub* no. 7892.
*Locality*: *N.W.*: N. of Dossali Fort, slopes of Picket Hill (B. & F. 1279 !).—Dossali Fort, 4,900 ft. (B. & F. 1038a !), left bank of Khaisora River, 4,800 ft. (B. & F. 1165 !).
*Flowers & Fruit*: 10-4-30 (Dossali); 15-4-30 (Dossali).
*Distribution*: India (N.-W. Provinces, Bihar, Assam, W. Peninsula), tropical Africa.

**Phyllanthus urinaria** L. Sp. Pl. (1753) 982.
*Locality*: *N.W.*: Razani, 5,000 ft. (F. 2360 !).
*Flowers & Fruit*: 27-4-27 (Razani).
*Distribution*: Tropics generally.

### CHROZOPHORA Neck.

10 species.—Mediterranean, India, W. Africa.

**Chrozophora obliqua** A. Juss. ex Spreng. Syst. Veg. iii (1826) 850 **var. genuina** Prain in Kew Bull. (1918) 112.
*Locality*: *S.W.*: Sarwekai, 3,930 ft. (F. 3962 !).
*Flowers*: 7-6-27 (Sarwekai).

*Distribution*: Mediterranean, Asia Minor, Syria, Mesopotamia, Persia, Turkestan.

**Chrozophora hierosolymitana** Spreng. Syst. Veg. iii (1826) 850; Prain in Kew Bull. (1918) 109.
*Locality*: *Tank* (Duthie 7205 ex Prain).
*Distribution*: N.W. India, N.W. Himalaya, Baluchistan, Afghanistan, Orient, Asia Minor, Arabia, Egypt.

RICINUS (Tourn.) L.

1 species.—Tropical Africa.

**Ricinus communis** L. Sp. Pl. (1753) 1007.
*Vernacular name*: Randanh (Waziri).
*Locality*: *N.W.*: Shewa Post, right bank of Kuram River (B. & F. 926 !).
*Distribution*: Tropics generally.

## ULMACEAE.

130 species.—Tropical and temperate regions.

CELTIS Tourn.

75 species.—N. hemisphere, S. Africa.

**Celtis australis** L. Sp. Pl. (1753) 1043.—*C. caucasica* Willd. Sp. Pl. iv, 994.
*Vernacular name*: Nettle tree; Taghar (Pu.); Togonh (Waziri).
*Locality*: *N.W.*: Razani, planted, 5,000 ft. (F. 2125 ! 2128 ! 2131 !).
*S.W.*: Bungi Wala, about 4,500 ft. (Stewart).—Sararogha, in garden, 4,000 ft. (F. 60 ! 104 ! 2645 !).—Kaniguram, about 8,200 ft. (Stewart).
*Flowers*: April.
*Fruit*: April, May.
*Distribution*: Baluchistan, Kuram Valley, Afghanistan, Salt Range, N.W. Himalaya up to 8,500 ft., often planted.

**Celtis tetrandra** Roxb. Hort. Beng. (1814) 21.
*Locality*: *N.W.*: Razani (Stewart).
*Distribution*: Oudh, Nepal, Sikkim up to 5,000 ft., Bihar, Central Provinces, Orissa, N. Circars, Deccan, W. Ghats, Assam, Chittagong, Burma.

## MORACEAE.

800 species.—Tropical and subtropical, a few temperate.

CANNABIS (Tourn.) L.

1 species.—Central Asia.

**Cannabis sativa** L. Sp. Pl. (1753) 1027.
*Locality*: *Tank*: Common weed in gardens N. of Tank, cultivated (Stewart).
*Distribution*: Wild in Central Asia.

*MORUS (Tourn.) L.

12 species.—N. temperate.

* **Morus nigra** L. Sp. Pl. 1398.
*Locality*: *S.W.*: Spin, planted by Kaka Khel tribe (F. 3847 !).—Tenai, 3,200 ft. (F. 3798 !).—Wana, 4,500 ft. (F. 3599 !).
*Distribution*: Europe, planted elsewhere.

* **Morus alba** L. Sp. Pl. (1753) 986; Parker For. Fl. Punj. (1918) 473.
*Vernacular name*: Mulberry; Teeth (Waziri); Tut.
*Locality*: *N.W.*: Boya, planted, 4,000 ft. (F. 1357 ! 1358 !).—Razani, cultivated, 5,000 ft. (F. 2177 ! 2184 ! 2189 !).—Miram Shah (B. & F. 521 !).
*S.W.*: Sararogha, cultivated, 4,000 ft. (F. 128 !).
*Tank* (J. Williams 9184 !).
*Flowers*: April.

*Fruit*: 28-3-30 (Miram Shah).
*Distribution*: Probably a native of China.—Cultivated in Afghanistan, Kuram Valley, Baluchistan, Punjab, Kashmir, N.W. Himalaya.

* **Morus laevigata** Wall. Cat. no. 4649.
*Vernacular name*: Teeth (Waziri).
*Locality*: *N.W.*: Boya, cultivated, 4,000 ft. (F. 1359 !).—Miram Shah, cultivated, 3,000 ft. (F. 1068 !).
*Flowers*: April.
*Fruit*: April at Miram Shah.
*Distribution*: Outer Himalaya from Kumaon eastwards, Assam, Khasia Hills, Upper Burma, Martaban, Tenasserim.

* **Morus indica** L. Sp. Pl. (1753) 986.
*Vernacular name*: Tuth (at Boya).
*Locality*: *N.W.*: Boya, cultivated, 4,000 ft. (F. 895 !).
*S.W.*: Sararogha, cultivated, 4,000 ft. (F. 23 !).
*Young fruit*: 30-3-27 (Boya).
*Distribution*: Sub-Himalayan tract in dry forests from the Sutlej eastwards, up to 5,000 ft. (Brandis).

* **Morus serrata** Roxb. Hort. Beng. (1814) 103.
*Vernacular name*: Teeth (Waziri).
*Locality*: *N.W.*: Razani, cultivated, 5,000 ft. (F. 2139 ! 2142 !).
*Distribution*: Baluchistan, Trans-Indus to Kumaon, chiefly in the inner ranges.

### Ficus Tourn. ex L.

800 species.—Tropics, chiefly E. Indies, Polynesia, etc.

**Ficus palmata** Forsk. Fl. Aeg.-Arab. (1775) 179.
*Vernacular name*: Inzar (Waziri); Toga.
*Locality*: *N.W.*: Miram Shah, wild, 3,000 ft. (F. 961 ! 962 ! 963 ! 964 !).—Razani, wild, 5,000 ft. (F. 2828 ! 2851 !).—Boya, 4,000 ft. (F. 897 ! 1350 ! cultivated).—Datta Khel, in garden, 4,600 ft. (B. & F. 1420 !).—Datta Khel village (B. & F. 1514 !).
*S.W.*: Razmak, below Springs, 7,700 ft. (B. & F. 1834 !).
*Tank*: (J. Williams 9228 !).
*Distribution*: Baluchistan, Eastern slopes of the Suleiman Range, Salt Range and plains of Punjab, Mt. Abu, Merwara, N.W. Himalaya up to 5,000 ft., on the Sutlej to 9,000 ft. eastwards as far as Nepal (Brandis).

* **Ficus religiosa** L. Sp. Pl. (1753) 1059.
*Vernacular name*: Pipal.
*Locality*: *Tank*: City of Tank, planted (Stewart).
*Distribution*: Wild in the Sub-Himalayan forests, Bengal, Central India, elsewhere cultivated.

* **Ficus carica** L. Sp. Pl. (1753) 1513.
*Locality*: *N.W.*: Miram Shah (F. 1069 !).
*Tank* (J. Williams 7211 !).
*Distribution*: Supposed to be indigenous in Syria and Palestine.

* **Ficus glomerata** Roxb. Corom. Pl. ii (1798) 13, t. 123.
*Locality*: *N.W.*: Miram Shah, planted (B. & F. 522 !).
*Distribution*: Throughout India, Ceylon.

## URTICACEAE.

480 species.—Tropics and temperate.

### Urtica (Tourn.) L.

30 species.—Temperate regions.

**Urtica dioica** L. Sp. Pl. (1753) 984.
*Vernacular name*: Sayankai (Afghanistan); Sisinaka, Sezinkae (Waziri) (=the stinger).

*Locality*: *N.W.*: Dariawasti Algad, near Datta Khel (B. & F. 1650 ! 1656 !).—Chasmai River, right bank, in silt between grass, 3,100 ft. (B. & F. 218 !).—Boya Fort, on sandy bank of Tochi River, 3,550 ft. (B. & F. 110 !).—E. of Datta Khel Fort, stony plain, 4,600 ft. (B. & F. 1344 !).—Below Dossali Fort, left bank of Khaisora River (B. & F. 1148 ! 1149 ! 1150 !).
*S.W.*: Pre Ghal (Hay).
*Flowers*: 23-3-30 (Chasmai River); 19-4-30 (Near Datta Khel).
*Fruit*: 13-4-30 (Dossali).
*Distribution*: N. W. Himalaya, 8,000-12,000 ft., Salt Range, westwards to the Atlantic.

**Urtica pilulifera** L. Sp. Pl. 1395.
*Vernacular name*: Sezankie, Sezinka (Waziri).
*Locality*: *N.W.*: Miram Shah (F. 386 !).
*S.W.*: Razmak (F. 2251 ! 2280 !).
*Flowers*: 14-4-27 (Miram Shah).
*Distribution*: Europe, N. Africa, Orient.

POUZOLZIA Gaudich.

40 species.—Palaeotropics.

**Pouzolzia sp.**
*Vernacular name*: Sezinka, Sezankie (Waziri).
*Locality*: *N.W.*: Miram Shah, 3,000 ft. (F. 386 !).
*S.W.*: Razmak, 6,500 ft. (F. 2251 ! 2266 ! 2280 !).
*Flowers*: April.

PARIETARIA (Tourn.) L.

7 species.—Temperate and tropics.

**Parietaria debilis** Forst. f. Prodr. 73; Boiss. Fl. Or. iv (1879) 1150.
*Locality*: *N.W.*: Miram Shah, 3,000 ft. (F. 508 ! 518 !).
*Flowers* & *Fruit*: April.
*Distribution*: Abyssinia, Afghanistan, Kuram Valley, Baluchistan, Punjab to Sikkim, China, many temperate and tropical regions, extending to Australia and Chili.

FORSKOHLEA L.

5 species.—Mediterranean to India.

**Forskohlea tenacissima** L. Mant. 72.
*Locality*: *S.W.*: Palosina, common on cliffs (Stewart).—Jandola, 2,270 ft. (F. 4116 !).
*Tank*: Near Tank (J. Williams 7892 !).
*Flowers*: 16-6-1888 (Tank).
*Distribution*: Punjab, Sind, Baluchistan, westwards to Arabia and N. Africa, Spain.

## PLATANACEAE.

1 genus.

*PLATANUS (Tourn.) L.

5 species.—N. temperate.

* **Platanus orientalis** L. Sp. Pl. 999.
*Locality*: *N.W.*: Miram Shah, 3,150 ft. (B. & F. 4 !).
*S.W.*: Razmak, planted in avenue, 6,500 ft. (F. 1557 ! 1558 !).
*Distribution*: Indigenous in the eastern Mediterranean region.—Cultivated in Afghanistan, Kuram Valley, Baluchistan, N.W. Himalaya, Punjab.

## JUGLANDACEAE.

40 species.—N. temperate, tropical Asia.

JUGLANS L.

12 species.—N. hemisphere, Andes.

**Juglans regia** L. Sp. Pl. (1753) 997.
*Vernacular name*: Matak (Waziri).
*Locality*: *N.W.*: Razani, cultivated, 5,000 ft. (F. 2081 ! 2012 ! 3013 ! 3014 !).
*S.W.*: Ridge of Pre Ghal (Stewart).
*Flowers*: April, May.
*Distribution*: Indigenous in the Kuram Valley, N.W. Himalaya, Sikkim, Upper Burma.

## BETULACEAE.

105 species.—N. temperate, tropical mountains, Andes, Argentine.

### *Alnus (Tourn.) L.

17 species.—N. temperate regions, Andes.

* **Alnus nitida** Endl. Gen. Pl. Suppl. iv, ii (1847) 20.
*Vernacular name*: Alder.
*Locality*: *S.W.*: Razmak, planted, 6,500 ft. (F. 1801 ! 1802 ! 1803 !).
*Distribution*: N.W. Himalaya, extending eastwards to the Jumna up to 9,000 ft., Kunawar, Hazara.

## FAGACEAE.

350 species.—Tropical Asia, California, S. America, New Zealand, S. Australia.

### Quercus (Tourn.) L.

300 species.—N. temperate, Indo-Malaya, Pacific coasts, etc.

**Quercus ilex** L. Sp. Pl. (1753) 995.
*Vernacular name*: Holm Oak, Chedai, Sperkai Chedai.
*Locality*: *N.W.*: Boya, common (F. 1506 ! 1508 !).—Above Dossali Fort, bank of Khunai River, 5,150 ft. and upwards (B. & F. 1143 ! 1145 !).—Dossali, in nala (B. & F. 1040 ! 1144 ! 1146 !).—Razani (F. 2078 ! 2135 ! 2817 ! 2818 !).
*S.W.*: Razmak (F. 3318 !).—S.W. of Razmak, hill, 6,950 ft. (B. & F. 1931 !, F. 1844 !).—E. of Razmak (F. 2784 ! 3294 ! 3314 ! 3351 ! 3347 !). —Pre Ghal (Hay, J. Williams 7927 !).—Near Kaniguram, 6,500-8,200 ft. (Stewart).—Wana (F. 3681 ! 3692 ! 3700 ! 3701 !).
*Leaves coming out*: 30-4-27 (Razmak).
*Flowers*: 12-4-30 (Dossali); 27-4-30 (Razmak); 5-5-27 (Razmak).
*Uses*: Fruit eaten. Wood used as fuel.
*Distribution*: Kuram Valley, 6,500-9,000 ft., N.W. Himalaya, Afghanistan, Mediterranean region.

**Quercus dilatata** Lindl. in Wall. Cat. (1828) no. 2785.
*Vernacular name*: Holly Oak, Gora chirai, Gada charai (Waziri).
*Locality*: *N.W.*: Razani, common (F. 2969 ! 2999 ! 3001 !).
*S.W.*: Pre Ghal (Hay, J. Williams 7926 !).—Razmak, below Springs, 7,700 ft. (B. & F. 1858 ! 1859 !, Palacios 1876a !, F. 1748 ! 1836 ! 2234 ! 2302 ! 2646 ! 3189 ! 3320 !).
*Young leaves coming out*: 25-4-27 (Razani); 5-5-27 (Razmak).
*Flowers*: 25-4-30 (Razmak).
*Distribution*: N.W. Himalaya, 5,000-9,000 ft., Kunawar, Kuram Valley, 7,000-8,500 ft., Afghanistan.

**Quercus semecarpifolia** Smith in Rees Cyclop. xxix (1819) no. 20.
*Vernacular name*: Ghadha, tcherai, Charlanza tcherai.
*Locality*: *S.W.*: Pre Ghal (Hay).—Shuidar, 9,000-10,000 ft. (F. 1532 ! 1533 !), associated with pines (F. 1649 ! 1670 ! 1671 ! 2546 !).—This is the oak of the higher regions.
*Distribution*: Kuram Valley, 9,000-11,000 ft., Himalaya 8,000-10,000 ft., E. Manipur 8,000-10,000 ft., China.

**Quercus incana** Roxb. Hort. Beng. (1814) 113.
*Vernacular name*: White Oak.

*Locality*: *N.W.*: Loargai Narai, 6,500 ft. (B. & F. 1535a !).
*S.W.*: Shuidar, 9,000-10,000 ft. (F. 1535 !).
*Distribution*: Outer N.W. Himalaya to Nepal, 4,000-8,000 ft., Salt Range, Trans-Indus.

**Quercus glauca** Thunb. Fl. Jap. (1784) 175.
*Locality*: *N.W.*: In the upper regions (Stewart), very likely planted.
*Distribution*: Valleys of the outer Himalaya up to 6,000 ft., Khasia Hills, China.

## SALICACEAE.

180 species.—N. temperate, tropics and subtropics.

### SALIX (Tourn.) L.

160 species.—Cosmopolitan.

**Salix acmophylla** Boiss. Diagn. ser. 1, vii (1846) 98.
*Vernacular name*: Vallah, Wollah (Waziri).
*Locality*: *N.W.*: Boya, along fields on bank of Tochi River, 4,000 ft. (F. 1338 ! 1339 ! 1340 ! 1342 !).—Isha (B. & F. 400 !).—Datta Khel, along Tochi River, 4,500 ft. (F. 1274 ! 1308 ! 1317 !).—Razani in patch of cultivation along stream, 5,000 ft. (F. 2141 !).—Spinwam Fort (B. & F. 430 !).
*S.W.*: Shuidar, 9,000 ft. (F. 1552 !).
*Flowers*: March, 27-3-30 (Spinwam); 30-3-30 (Boya); April.
*Distribution*: Afghanistan, Kuram Valley, Baluchistan, N. Punjab, Kashmir, sub-Himalayan tract east of the Ganges, W. Asia.
*Uses*: Eaten by camels. Wood burnt and coal used in making crackers.

**Salix Wallichiana** Anders. in Act. Holm. (1850) 447.
*Vernacular name*: Vallah (Waziri).
*Locality*: *S.W.*: Sararogha, along Tank River, 4,000 ft. (F. 17 ! 18 !).
*Distribution*: Afghanistan, Kuram Valley, 10,000-12,000 ft., Himalaya 2,000-9,000 ft., China.

* **Salix babylonica** L. Sp. Pl. 1017; Boiss. Fl. Or. v (1884) 1185.
*Vernacular name*: Weeping Willow, Vallah.
*Locality*: *N.W.*: Miram Shah, in fields along Tochi River, 3,000 ft. (F. 795 ! 965 !).—Dwa Warkha (Stewart).
*S.W.*: Razmak, in garden (B. & F.).—Wana, S.E. of Camp, 4,500 ft. (F. 3577 ! 3586 ! 3610 !).—Wana, in garden along stream (F. 3595 !).—Jandola, along Tank River, 2,200 ft. (F. 786 !).—Above Palosina, along banks of stream (Stewart).
*Flowers*: June.
*Distribution*: Indigenous in N. China, also very likely in N. Persia and Kurdistan.

* **Salix alba** L. Sp. Pl. 1021.
*Locality*: *N.W.*: Datta Khel village, 4,600 ft. (B. & F. 1488 !).—Datta Khel Fort, 4,600 ft. (B. & F. 1365 ! 1366 !).
*Fruit*: 16-4-30 (Datta Khel Fort); 17-4-30 (Datta Khel village).
*Distribution*: Europe, Orient, N. Asia. Cultivated in N.W. Himalaya.

### POPULUS L.

20 species.—N. temperate.

**Populus suaveolens** Fisch., Led. Fl. Ross. iii, 629; Fedtschenko & Fedtschenko Consp. Fl. Turk. pt. 6 (1916) 332.—*P. balsamifera* Hook. f. in Fl. Brit. Ind. v (1888) 638; Brandis Ind. Trees (1911) 640, *et aliorum auctorum, non Linn.*—*P. balsamifera var. laurifolia* Wesm. *et var. suaveolens* Loud., Rgl. in Act. Hort. Petrop. vi, 474 *et* 475.—*P. laurifolia* Led. Fl. Alt. iv, 297 (*excl. syn. plur.*); Led. Fl. Ross. iii, 629.
*Vernacular name*: Balsam Poplar, Chenar.
*Locality*: *N.W.*: Datta Khel Fort, 4,600 ft. (B. & F. 1416 !).
*S.W.*: Wana, planted, said to be introduced from Kabul, 4,500 ft. (F. 3647 !).

*Distribution*: Indigenous in Central and N. Asia and, according to some, in N. America.

**Populus euphratica** Oliv. Voy. iii (1801) 449, tab. 45, 46.
*Locality*: *S.W.*: Above Palosina, along banks of stream (Stewart).
*Distribution*: Sind, Baluchistan, Afghanistan, Punjab, W. Tibet, westwards to Syria and Egypt.

**Populus nigra** L. Sp. Pl. (1753) 1034, **var. pyramidalis** Spach; Aitchis. Bot. Afgh. Del. Com. (1888) 111; Burkill Fl. Pl. Baluch. (1909) 72; Brandis Ind. Trees (1911) 640; Parker For. Fl. Punj. (1918) 511.
*Vernacular name*: Pyramidal Poplar, Lombardy Poplar.
*Locality*: *S.W.*: Between Dargai Post and Sarwekai (F. 3707 ! 3708 !).
*Distribution*: 'It is a staminate sport from *P. nigra var. typica*, originating in the plains of Lombardy about 1,700-1,720 ft. and now widely spread over the world by means of cuttings' (L. H. Bailey).
'Frequently planted in the N.W. Himalaya, particularly in Kashmir, in Ladak as high as 12,500 ft. Also occasionally in the plains of the Punjab, and of late years in Baluchistan' (Brandis).

***Populus alba** L. Sp. Pl. (1753) 1034.
*Vernacular name*: White Poplar; Spedore (Waziri); Sufedor (at Tank).
*Locality*: *N.W.*: Dwa Warkha (Stewart).—Razani, cultivated, 5,000 ft. (F. 2147 ! 2149 !).—Datta Khel village, 4,600 ft. (B. & F. 1438 !).
*S.W.*: Dargai Post, planted (F. 4068 ! 4181 !).—Wana, planted, 4,500 ft. (F. 3486 ! 3487 ! 3605 !).—Above Palosina along banks of stream (Stewart).—Sararogha (F. 119 !).
*Tank* (J. Williams 9229).
*Distribution*: N.W. Himalaya, 4,000-10,000 ft., wild and cultivated. Planted in Baluchistan, Kuram Valley, Punjab, Europe, N. Africa, N. and W. Asia, China (Brandis).
*Uses*: Planted for timber.

***Populus tremula** L. Sp. Pl. 1464.
*Vernacular name*: Spolilai (Waziri).
*Locality*: *N.W.*: Miram Shah, 3,150 ft. (B. & F. 40 !).—Datta Khel village, 4,600 ft. (B. & F. 1436 !).
*Distribution*: Europe, Orient, Siberia, Dahuria, Japan, N. Africa.

## GNETACEAE.

800 species.—Cosmopolitan.

### EPHEDRA Tourn. ex L.

25 species.—Warm temperate.

**Ephedra foliata** Boiss. Fl. Or. v (1881) 716.—*E. peduncularis* Boiss. l.c. 717.
*Vernacular name*: Khadang-gawa, Gadanga-gawa, Creda, Ghardavangha.
*Locality*: *N.W.*: Boya Fort, right bank of Tochi River, 3,550 ft. (B. & F. 84 !, F. 1112 ! 1465 !), on sandy clay (B. & F. 1684 !).—Miram Shah, hills E. of, 3,600 ft. (B. & F. 557 ! 558 ! 993 !).—Near Miram Shah, rocky bank of Chasmai River (B. & F. 296a !).—Dossali Fort, left bank of Khaisora River (B. & F. 1166 !).—N. of Dossali Fort, rocky nala, climbing on *Quercus ilex* (B. & F. 1290 ! 1291 !).—Dossali, right bank of Khunai River, 5,500 ft. (B. & F. 1139 !).—Spinwam Fort, slope of Chota Darweshta, 3,000-4,800 ft. (B. & F. 751 !).—Spinwam, nearest hill E. of, 2,900 ft. (B. & F. 802 ! 809 !).—Shewa Post (B. & F. 917 ! 918 !).
*S.W.*: Razmak, below Springs, 7,700 ft. (B. & F. 1869 !).—Hill E. of Razmak Camp, 6,800 ft. (B. & F. 1877 !).—Jandola (F. 2024 ! 4099 !).—Sarwekai (F. 4045 !).
*Flowers*: 29-3-30 (Miram Shah); 2-4-30 (Spinwam); 5-4-27 (Boya); 13-4-27 (Miram Shah); 24-4-30 (Boya).
*Fruit*: 29-5-27 (Jandola).
*Distribution*: Punjab, Rajputana, Sind, Baluchistan, Afghanistan to Syria.

**Ephedra Gerardiana** Wall. Cat. (1828) no. 6048.—*E. vulgaris* Hook. f. in Fl. Brit. Ind. v, 640.

*Locality*: *S.W.*: N. of Razmak Camp, below Springs, 7,700 ft. (B. & F. 1806 !).—Slope of Shuidar, 9,000-11,000 ft. (F. 1542 !).—Shuidar, forming clumps at about 8,000 ft. (F. 1625 !).

*Distribution*: Temperate and alpine Himalaya 7,000-12,000 ft., Sikkim 12,000-16,000 ft., W. and Central Asia, Europe.

**Ephedra nebrodensis** Tineo in Guss. Fl. Sic. Syn. ii, 638, **var. procera** Stapf.

*Locality*: *S.W.*: Razmak (Herb. Dehra Dun 47326 !).

*Distribution*: Mediterranean, N. Asia.

## PINACEAE.

About 300 species.—Mostly temperate.

### Abies (Tourn.) L.

**Abies Pindrow** Spach Hist. Phanerog. xi, 423; Royle Ill. t. 86; Parker For. Fl. Punj. (1918) 542; Troup Silvic. Ind. Trees (1921) 1133.—*A. Webbiana* Lindley *var. Pindrow* Brandis For. Fl. (1874) 528; Hook. f. in Fl. Brit. Ind. v, 655.—*Pinus Pindrow* Royle Ill. 354, t. 86.

*Vernacular name*: W. Himalaya low-level silver fir; Almanza (Waziri).

*Locality*: *S.W.*: N. of Razmak Camp (F. 1609 ! 2538 !).—Slope of Shuidar, 9,000-11,000 ft. (B. & F. 1628 !).

*Distribution*: Kuram Valley, W. Himalaya from Afghanistan to Nepal 7,500-11,000 ft. and even up to 12,000 ft., Chitral.

### Picea Link.

35 species.—N. hemisphere.

**Picea Morinda** Link in Linnaea xv, 522; Hook. f. in Fl. Brit. Ind. v, 653; Brandis Ind. Trees (1911) 692; Troup Silvic. Ind. Trees (1921) 1143.—*Abies Smithiana* Forbes Pinet. Woburn. 103, t. 30; Aitchis. Fl. Kuram Valley (1880) 98; Brandis For. Fl. (1874) 525.—*Picea Smithiana* Boiss. Fl. Or. v (1884) 700.—*Pinus Khutrow* Royle Ill. 353, t. 84.—*Abies spinulosa* Griff. Ic. Pl. As. t. 363.

*Vernacular name*: The Himalayan Spruce; Sarap (Waziri).

*Locality*: *S.W.*: N. of Razmak Camp (F. 1663 ! 1725 ! 1776 ! 1779 ! 1786 ! 1787 ! 1788 ! 2314 ! 2418 ! 2450 ! 2478 ! 2509 ! 3035 ! 4183 ! 4201 ! 4453 !).—Slope of Shuidar, 9,000-11,000 ft. (B. & F. 1627 !).

*Distribution*: Kafiristan, Chitral, Kuram Valley, Himalaya from Kashmir to Garhwal, 7,000-11,000 ft., Sikkim and Bhutan, 8,000-15,000 ft.

### Pinus (Tourn.) L.

70 species.—N. temperate and on mountains in the N. tropical regions.

**Pinus excelsa** Wall. Pl. As. Rar. t. 201; Griff. Ic. Pl. As. t. 366; Boiss. Fl. Or. iv (1879) 698; Troup Silvic. Ind. Trees (1921) 1815.

*Vernacular name*: Blue Pine, Nastar (Waziri); Nuhktar in Kuram Valley (ex Aitchis.).

*Locality*: *S.W.*: Pre Ghal (J. Williams 7928 !).—Razmak Camp, plentiful, forming small forests on the hill range N. of Razmak. Associated with *Quercus ilex* L. (F. 1723 ! 1724 ! 1732 ! 1772 ! 2384 ! planted, 2536 ! 2537 ! 4451 ! 4452 !).—On top of Shuidar Peak, 10,980 ft. and on the slopes of the range N. of Razmak Camp (F. 2532 ! 4224 !).—Cone picked up in the Tank River at Jandola, very likely carried down from the higher hills (F. 4185 !).—Slopes of Shuidar, 9,000 ft. (B. & F. !).

*Distribution*: Throughout the temperate regions of the Himalaya, chiefly 6,000-12,500 ft., to Bhutan (not in Central & N.W. Kumaon and Sikkim), Afghanistan, Kafiristan, Kuram Valley, Baluchistan (Zob and Loralai).

*Medical uses*: Resin used by local practitioners against impotence. Prepared in milk or honey and then mixed with an equal quantity of sugar, it is taken for 40 days.

**Pinus Gerardiana** Wall. in Lamb. Pin. Ed. 3, t. 79; Brandis For. Fl. (1874) 508, t. 67, Ind. Trees 690; Royle Ill. t. 85; Clegh. Pines N.W. Himalaya t. 4; Parker For. Fl. Punj. (1918) 539.

*Vernacular name*: Himalayan edible pine, Chilgoza pine; Zangezie, Zanguzie (Waziri).

*Locality*: *N.W.*: Cones picked up in the Tochi River at Boya (F. 4203 !).
*S.W.*: On top of Shuidar Peak, only a few trees, 10,980 ft. (F. 1773 ! 1774 ! 1775 ! 1777 ! 1778 ! 2341 ! 2494 ! 2510 ! 2511 ! 2512 ! 4449 !).—Plentiful on slopes N. of Razmak Camp (F. 2495 !).—Slopes of Shuidar, 9,000-11,000 ft. (B. & F. 1626 !).

*Distribution*: Afghanistan (Khost, Kafiristan), Baluchistan (Zhob, Takht-i-Suliman), Kuram Valley (Hariab 7,000-11000 ft.), from Chitral to the Niti Pass in Garhwal chiefly between 6,000-10,000 ft.

*Uses*: Nuts eaten as is done everywhere where the pine occurs, seeds sold in Bannu.

***Pinus longifolia** Roxb. Fl. Ind. iii (1832) 651; Royle Ill. t. 85.
*Vernacular name*: Chir Pine.
*Locality*: *N.W.*: Miram Shah, garden, 3,150 ft. (B. & F. 35 !).
*S.W.*: Above Anai Gorge in bed of stream, cultivated (Stewart).
*Distribution*: Afghanistan, along the Himalaya and Siwalik Hills to Bhutan, 1,500-8,000 ft. (Parker).

### Cupressus Tourn. ex L.

12 species.—Mediterranean, Asia, N. America.

***Cupressus sp**.—Too incomplete for determination.
*Locality*: *S.W.*: Jandola (F. 1524 ! 1526 !).

### Thuja L.

6 species.—China, Japan, N. America.

***Thuja orientalis** L. Sp. Pl. 1002.—Oriental Arbor-vitae.
*Locality*: *N.W.*: Miram Shah (F. 2361 ! 2364 !). Planted.
*Fruit*: March, young fruits and fruits of the previous year.
*Distribution*: China, Japan.

### Cedrus (Tourn.) Mill.

3 species.—Algeria to Himalaya.

**Cedrus Deodara** Loud. Arb. Brit. iv, 2428, f. 2283-2286; Boiss. Fl. Or. iv (1879) 699.—*C. Libani var. Deodara* Hook. f. Himalay. Journ. i, 257.—*Pinus Deodara* Roxb. Fl. Ind. iii, 651.
*Vernacular name*: Himalayan Cedar, Deodar; Almanzha (Waziri).
*Locality*: *S.W.*: Shawal, N. of Razmak Camp (F. 4166 ! 4167 ! 4168 ! 4169 ! 4170 ! 4171 ! 4212 ! 4241 !).
*Distribution*: Afghanistan, Chitral, Kuram Valley, 7,500-10,000 ft., N.W. Himalaya, 4,000-10,000 ft. as far east as Alaknanda, sometimes up to 12,000 ft.

## MONOCOTYLEDONEAE.

## ORCHIDACEAE.

7,500 species.—Cosmopolitan, abundant in tropical, rare in arctic regions.

### Eulophia R. Br.

200 species.—Warm regions of the Old World.

**Eulophia campestris** Wall. Cat. 7617.
*Locality*: *S.W.*: Wana, 4,500 ft. (Duthie's Collect. 15776 !).
*Flowers & Fruit*: 11-5-1895 (Wana).
*Distribution*: Plains of India, Sikkim, Afghanistan.

### CEPHALANTHERA Rich.

10 species.—N. temperate regions.

**Caphalanthera ensifolia** Rich. Orchid. Annot. 29.
*Locality*: *S.W.*: Kaniguram village (Stewart).—Razmak (F. 3133 ! 3138 ! 3159 ! 3256 !).
*Flowers*: 5-5-27 (Razmak).
*Distribution*: Temperate Himalaya, 6,000-12,000 ft., from Kashmir to Bhutan, Afghanistan to N. Africa, Europe, W. Siberia.

### EPIPACTIS Adans.

10 species.—N. temperate regions.

**Epipactis Royleana** Lindl. in Roy. Ill. 368.—*E. gigantea* Dougl. in Hook. Fl. Bor. Amer. ii, 202, t. 202.
*Locality*: Waziristan (Duthie in Orchids of N. W. Himalaya, p. 162).
*Distribution*: Temperate Himalaya, from Kashmir to Sikkim 7,000-12,000 ft., N. America.

## IRIDACEAE.

800 species.—Tropical and temperate regions; the chief centres of distribution S. Africa and tropical America.

### IRIS Tourn. ex L.

200 species.—N. temperate.

**Iris Sisyrinchium** L. Sp. Pl. (1753) 59.
*Vernacular name*: Khikhai, Dilai, Diliae (Waziri).
*Locality*: *N.W.*: Datta Khel, 4,600 ft. (Dundas 72 !, F. 1248 !).—Boya, on clay, 3,550 ft. (B. & F. 1686 !, F. 1091 !), along water channels (F. 1039 !), in cultivation (F. 1136 ! 1162 ! 1164 !).—Miram Shah (F. 357 !, B. & F. 30 ! 474 !).—Right bank of Chasmai River, in field, 3,120 ft. (B. & F. 296 !).
*Flowers*: 19-3-30 (Miram Shah); 20-3-30 (Datta Khel); 25-3-27 (Datta Khel); 28-3-27 (Boya); 28-3-30 (Miram Shah); 5-4-27 (Boya); 16-4-27 (Miram Shah); 21-4-30 (Boya).
*Fruit*: 28-3-27 (Boya); 16-4-27 (Miram Shah); 21-4-30 (Boya).
*Distribution*: Baluchistan, Afghanistan, Orient, Mediterranean, N. Africa.

**Iris Stocksii** Boiss. Fl. Or. v, 123.
*Locality*: *N.W.*: Datta Khel, stony ground (F. 1183 ! 1188 !).—Bed of Khunai River, near Dossali, 5,050 ft. (B. & F. 1089 ! 1181 !).—Razani (F. 2044 !).
*S.W.*: Slopes of Shuidar, 7,000-9,000 ft. (F. 1586 !).
*Flowers*: 24-3-27 (Datta Khel).
*Fruit*: 13-4-30 (Dossali); 18-4-30 (Shuidar); 20-4-27 (Razani).
*Distribution*: Baluchistan, Kuram Valley, Afghanistan.

**Iris ensata** Thunb. in Trans. Linn. Soc. ii, 328.
*Locality*: *N.W.*: Boya (B. & F. !).
*Distribution*: W. Himalaya, 5,000-9,000 ft., temperate Asia.

***Iris pumila** L. Sp. Pl. 38.
*Locality*: *S.W.*: Razmak, in garden (B. & F. !).
*Distribution*: Europe, N. Asia.

## AMARYLLIDACEAE.

1,050 species.—Usually tropical or subtropical.

### CRINUM L.

70 species.—Tropical and subtropical regions.

***Crinum Powellii** Hort. = *C. Moorii* Hook. f. × *C. longifolium* Thunb.
*Locality*: *S.W.*: Razmak, planted (B. & F. !).
*Distribution*: Parents of Africa.

### IXIOLIRION Fisch.

2 species.—W. Asia.

**Ixiolirion tataricum** Schult. f. Syst. vii, 752.—*Amaryllis tatarica* Pall. Reise iii (1776) 727.—*I. Palasii* Fisch. & Mey. ex. Led. Fl. Ross. iv (1842-1852) 116.—*I. montanum* Kunth Enum. Pl. v (1850) 817.—*I. Ledebouri* Fisch. & Mey. in Bong & Mey. Suppl. Fl. Alt. no. 293.—*I. montanum* Herb. Amar. (1837) 125, t. 20, f. 3.

We have united *I. montanum* and *I. Pallasii* under the much older specific name *tatarica*. The differences between the two species mentioned by Boissier are very variable. As to the anthers Gilliat Smith and Turril mention a specimen from Persia with the anthers 6 mm. long and another measuring 3.5-4 mm. [Kew Bull. (1930) 487].

*Locality*: *N.W.*: Near Miram Shah village, in a wheat field (B. & F. 518 ! 519 !).

*S.W.*: Razmak, gravel-plain, 6,800 ft. (B. & F. 1707 ! 1708 !).—N. of Razmak, on way to Springs, on gravel, 6,700-7,300 ft. (B. & F. 1768 ! 1805 !, F. 1624 !).—Very rare.

*Flowers*: 28-3-30 (Miram Shah); 24-4-30 (Razmak); 25-4-30 (Razmak); 8-5-27 (Razmak).

*Young fruits*: 24-4-30 (Razmak).

*Distribution*: Baluchistan, Kuram Valley, Afghanistan, Persia to Asia Minor, Soongaria, Siberia.

### NARCISSUS (Tourn.) L.

40 species.—Europe, Mediterranean, Asia.

***Narcissus pœticus** L. Sp. Pl. 289.

*Vernacular name*: Poet's Narcissus, Pheasant's Eye.

*Locality*: *N.W.*: Miram Shah, garden, 3,150 ft., doing well (B. & F. 24 !).

*Flowers*: 19-3-30 (Miram Shah).

*Distribution*: Mediterranean region.

## LILIACEAE.

2,700 species.—Cosmopolitan.

### ASPARAGUS L.

120 species.—Europe, temperate and tropical Asia and Africa.

**Asparagus gracilis** Royle Ill. i, 393.

*Locality*: *S.W.*: Sarwekai (F. 4006 !).

*Distribution*: Punjab, Baluchistan.

**Asparagus capitatus** Baker in Journ. Linn. Soc. xiv, 607.

*Vernacular name*: Gadavanga (Mashudi).

*Locality*: *N.W.*: Miram Shah (F. 1383 ! 1399 !).

*S.W.*: Sarwekai (F. 3902 !).—Sarwekai to Dargai (F. 3706 ! 3709 !).—Wana (F. 3892 !).

*Tank*: Near Tank (J. Williams 7212 ! 7919 ! 9189 ! 9190 !).

*Flowers*: 22-6-27 (Sarwekai).

*Fruit*: 2-7-1888 (Tank).

*Distribution*: Foot of W. Himalaya, 1,000-3,000 ft., Nilgiris.

**Asparagus dumosus** Baker in Journ. Linn. Soc. xiv, 609.

*Vernacular name*: Bzachoa, Gadhavanga (Waziri).

*Locality*: *N.W.*: Datta Khel, open stony plain (F. 1295 !).—Boya (F. 1462 !).—Chasmai River, rocky bank (B. & F. 862a !).—W. of Spinwam Fort, gravel, 2,650 ft. (B. & F. 862 !).

*Distribution*: Sind, Baluchistan.

*Uses*: Eaten by camels and goats.

**Asparagus racemosus** Willd. Sp. Pl. ii, 152.

*Vernacular name*: Gadavanga, Gadangava.

*Locality*: *N.W.*: Datta Khel (F. 1318 !).—Miram Shah (F. 1449 !).—N. of Spinwam Fort on disintegrating limestone hill, 2,650 ft. (B. & F. 819 !).

—W. of Spinwam, on hill, 2,650 ft. (B. & F. 449 !).—On slope of Chota Darweshta, 3,000-4,800 ft. (B. & F. 751a !).—N. of Dossali Fort, stony plain, 4,900 ft. (B. & F. 991 !).—2 miles N. of Dossali Fort, 5,150 ft. (B. & F. 1138 !).—Razani (F. 2878 !).

*S.W.*: Sararogha (F. 47 ! 75 !).

*Distribution*: Tropical and subtropical India and Ceylon, Himalaya up to 4,000 ft., Baluchistan, tropical Africa, Java, Australia.

**Asparagus ascendens** Roxb. Fl. Ind. iii (1832) 153.
*Locality*: *N.W.*: E. of Miram Shah Fort, hill (B. & F. 565 !).
*S.W.*: N. of Razmak towards Springs, 6,700-7,300 ft. (B. & F. 1758 !). —Jandola, open stony ground and nalas (F. 671 !).—Along Tank River (F. 712 !).
*Flowers*: 26-5-27 (Jandola).
*Fruit*: 24-5-27 (Jandola).
*Distribution*: Rohilkhand, W. Himalaya, Punjab, Afghanistan.

**Asparagus trichophyllus** Bunge Enum. Chin. bor. 65.
*Vernacular name*: Gadawanya (at Razani); Gadangava (at Sararogha).
*Locality*: *N.W.*: Datta Khel village, 4,700 ft. (B. & F. 1437 !).—N. of Boya Fort towards Tochi River, 3,550 ft. (B. & F. 89 !).—Shewa Post, bed of Volam River (B. & F. 908 !).—N. of Dossali Fort, in nala, 4,900 ft. (B. & F. 1266 !).—Razani (F. 2056 !).
*S.W.*: Sararogha (F. 178 !).
*Distribution*: Afghanistan, Armenia, S.E. Russia, Soongaria, Turkestan, N. China.

**Asparagus monophyllus** Baker in Journ. Linn. Soc. xiv, 604.
*Vernacular name*: Gadanggoa (Waziri).
*Locality*: *N.W.*: Miram Shah (F. 965 ! 986 !).
*Distribution*: Baluchistan.

**Asparagus verticillatus** L. Sp. Pl. 450; Boiss. Fl. Or. v, 339.
*Locality*: *N.W.*: Miram Shah (F. 288 !).
*Distribution*: Persia, Orient, S. Europe, W. Russia.

**Asparagus scaber** Brign. Fasc. Forojul. 92; Boiss. Fl. Or. v, 336.
*Locality*: *S.W.*: Jandola, open stony ground and nalas (F. 637 !).
*Distribution*: Caucasus, Mediterranean, Siberia.

**Asparagus? acutifolius** L. Sp. Pl. 449; Boiss. Fl. Or. v, 337.
*Locality*: *S.W.*: Jandola, along Tank River (F. 722 !).
*Distribution*: Mediterranean.

### EREMURUS Bieb.

20 species.—Alpine W. and Central Asia.

**Eremurus persicus** Boiss. Diagn. ser. 1, vii, 119; Fl. Or. v, 327.
*Vernacular name*: Khezi (Waziri).
*Locality*: *N.W.*: Near Dossali Fort, highest point of Picket no. 1 (B. & F. 1074 !).
*Flowers*: 11-4-30 (Dossali).
*Distribution*: Baluchistan, Persia.

**Eremurus Aitchisoni** Baker in Journ. Linn. Soc. xviii, 102.
*Vernacular name*: Pioz (Waziri).
*Locality*: *N.W.*: W. of Spinwam Fort, on slope of Chota Darweshta (B. & F. 738 !).
*Distribution*: Kuram Valley.

### ALLIUM (Tourn.) L.

325 species.—N. hemisphere.

**Allium Schœnoprasum** L. Sp. Pl. 432.—*A. sibiricum* Linn. Mant. 562.
*Vernacular name*: Yovrai (Waziri).
*Locality*: *N.W.*: In bed of Khunai River below Razani, 5,050 ft. (B. & F. 1132 !).—Bed of Khunai River above Dossali, 5,000 ft. (B. & F. 1132 !).

*S.W.*: In gravel on way to Springs N. of Razmak, 6,750-7,300 ft. (B. & F. 1769 !).

*Flowers & Fruit*: 12-4-30 (Razani, Khunai River); 25-4-30 (Razmak).

*Distribution*: Baluchistan, Orient.

*Uses*: Bulb eaten.

**Allium rubellum** M. Bieb. Fl. Taur. Cauc. i, 264.—*A. leptophyllum* Wall. Cat. 5073A.

*Vernacular name*: Garanai Pioz (Waziri).

*Locality*: *N.W.*: Datta Khel Fort, on gravel plain, 4,600 ft. (B. & F. 612 !).

*S.W.*: Pre Ghal (Hay).—Near Palosina (Stewart).

*Flowers*: September 1860 (Palosina, Pre Ghal).

*Distribution*: W. Himalaya, from Kashmir to Kumaon, 1,500-8,000 ft., Punjab. Westwards to the Ural, and in Siberia.

**Allium rubellum** M. Bieb. **var. grandiflora** Boiss. Fl. Or. v., 253.—*A. Griffithianum* Boiss. Diagn. ser. 2, iv, 117.—*A. vulcanicum* Boiss. in Pl. Kotsch. Pers. Bot. No. 49.

*Vernacular name*: Spai khukh (Williams); Pioziki, Piozgai (Waziri).

*Locality*: *N.W.*: Bed of Sua Algad near Khajuri Post, in gravel and sand, 2,250 ft. (B. & F. 373 !).—Khajuri, bed of Tochi River, in sand (B. & F. 412 !).—S. of Miram Shah, gravel plain, 3,150 ft. (B. & F. 481 !), in cultivation (F. 385 !).

*S.W.*: (J. Williams 9188 !).—Razmak (F. 3038 !).

*Tank* (J. Williams !).

*Flowers & Fruit*: 26-3-30 (Khajuri); 28-3-30 (Miram Shah); 14-4-27 (Miram Shah); 1-5-1891 (Tank); 2-5-27 (Razmak); 20-6-1888 (S.W.).

*Distribution of var.*: Kashmir, 5,000-7,000 ft., Baluchistan, Afghanistan, westwards to Persia.

**Allium umbilicatum** Boiss. Diagn. ser. 2, iv, 113; Fl. Or. v, 251.

*Locality*: *N.W.*: Near Datta Khel village, 4,600 ft. (B. & F. 1516 !).

*Flowers with bulbils*: 17-4-30 (Datta Khel).

*Distribution*: Baluchistan, Kuram Valley.

**Allium cupani** Raf. Car. (1818) 86; Boiss. Fl. Or. v, 265.

*Locality*: *N.W.*: Loargai Narai, 6,600 ft. (B. & F. 1311 !).

*S.W.*: N. of Razmak, towards Springs, on gravel, 6,700-7,300 ft. (B. & F. 1769 !).

*Flowers*: 16-4-30 (Loargai Narai); 25-4-30 (Razmak).

*Distribution*: S. Europe, Mediterranean.

**Allium djimilense** Boiss. Fl. Or. v, 265.

*Locality*: *N.W.*: N. of Dossali Fort, on stony plain, 4,900 ft. (B. & F. 982 !).

*Flowers*: 10-4-30.

*Distribution*: Pontus.

**Allium cassium** Boiss. Diagn. ser. 1, xiii, 28.

*Locality*: *N.W.*: W. of Spinwam, slopes of Chota Darweshta, 2,750-3,000 ft. (B. & F. 704 !).

*Flowers*: 2-4-30 (Spinwam).

*Distribution*: Syria, Cilicia.

**Allium moschatum** L. Sp. Pl. 427.

*Vernacular name*: Spipekh, Spikikh (Waziri).

*Locality*: *N.W.*: Near Miram Shah, right bank of Chasmai River, on sandy clay, 3,100 ft. (B. & F. 236 !).—Loargai Narai, in a tuft of grass, 6,600 ft. (B. & F. 1322 !).

*Distribution*: Persia, Caucasus, S. Europe.

### FRITILLARIA L.

50 species.—N. temperate regions.

**Fritillaria imperialis** L. Sp. Pl. 303.

Sometimes the bracts are broadly lanceolate. The flowers are generally shorter than described.

*Locality*: *S.W.*: Shuidar, 7,000-9,000 ft. (F. 1462 ! 1604 ! 1606 !).
*Flowers*: 18-4-30 (Shuidar).
*Distribution*: W. Himalaya, 7,000-9,000 ft., Afghanistan, Persia, Kurdistan.

**Fritillaria imperialis** L. **forma uniflora** Blatter.
*Locality*: *S.W.*: Shuidar, 7,000-9,000 ft. (F. 1605 !).
*Flowers*: 18-4-30 (Shuidar).

### TULIPA L.

50 species.—N. temperate regions of the Old World, especially on the steppes of Central Asia.

**Tulipa chrysantha** Boiss. in Kotsch. Pl. Pers. Bor. Exsicc. 1846, no. 17; Fl. Or. v, 193.
*Vernacular name*: Sundai (Waziri).
*Locality*: *N.W.*: Near Miram Shah village, in wheat field together with *Iris* (B. & F. 529 !).—Datta Khel (F. 1187 ! 1193 ! 1194 ! ).—Razani (F. 1190 ! 2886 ! 2927 ! 2932 ! 2935 ! 2937 !).—Chota Darweshta, on stony slope, 2,750 ft. (B. & F. 722 !).—Boya, on stony slope S. of Boya Post (F. 558 !).
*S.W.*: N. of Razmak, near Springs, 7,700 ft. (B. & F. 1804 !).—Razmak (F. 2020 ! 2027 ! 3120 !).
*Flowers*: 24-3-27 (Datta Khel); 28-3-30 (Miram Shah); 8-4-27 (Boya); 14-4-30 (Razmak); 19-4-27 (Razani); 25-4-30 (Razmak); 30-4-27 (Razmak); 8-5-27 (Razmak).
*Distribution*: Punjab, Salt Range, Baluchistan, Afghanistan, Turkestan, Persia, Central Asia.

**Tulipa montana** Lindl. Bot. Reg. t. 1106.
*Vernacular name*: Shundai (Waziri).
*Locality*: *N.W.*: Dossali, in nala and on slope leading to Picket Hill (B. & F. 1278 !).
*Old fruit* of previous year: 15-4-30 (Dossali).
*Distribution*: Afghanistan, Baluchistan, Persia, Mesopotamia, Syria, Palestine.

**Tulipa Fernandezii** [1] Blatter *sp. nov.* [*Liliacea. Refert T. porphyreo-chrysantham* Blatter, *sed distinguitur caule duplo maiore, 24 cm. attingente, pedunculo rubro, foliis pedunculo semper multo brevioribus, omnibus acuminatis, inferioribus lanceolatis, superioribus linearibus, phyllis perigonii externis oblongo-acutis vel oblongo-apiculatis (non acuminatis), internis oblongo-obtusis (non obovatis), omnibus ad 19 mm. longis, ca. 7 mm. latis, staminibus 8 mm. longis, dimidium perigonii attingentibus, filamentis quam antherae brevioribus.*]

*Bulbus ovatus, 12×8 mm., rufo-brunneus, intus rufescenti-villosus. Caulis cum pedunculo usque ad 24 cm. altus, erectus, glaber. Folia 4, pedunculo semper multo breviora, omnia acuminata, erecta, inferiora lanceolata, ad 12 cm. longa, 9 mm. lata, superiora lanceolato-linearia, omnia margine anguste cartilaginea, subundulata. Pedunculus ruber. Phylla perigonii ad 19 mm. longa, ca. 7 mm. lata, externa quidem oblongo-acuta vel oblongo-apiculata (non acuminata), intus flava, extus rubra, interna oblongo-obtusa (non obovata) utrimque flava. Stamina 8 mm. longa, dimidium perigonii attingentia; filamenta antheris aliquantulum breviora. Capsula oblongo-cylindrica, angustior versus apicem.*

Bulb ovate, 12×8 mm., dark brown, inside near the top rufescent-villous. Stem, including the peduncle up to 24 cm. high, erect, glabrous. Leaves 4, always much shorter than the peduncle, all acuminate, erect, more or less strict, the lower ones lanceolate, up to 12 cm. long, 9 mm. broad, the upper ones lanceolate-linear, all with a narrowly cartilaginous margin, subundulate. Peduncle red. Perigone-leaves up to 19 mm. long, ca. 7 mm. broad, the outer ones oblong-acute or oblong-apiculate (not acuminate), inside yellow, outside red, the inner ones oblong-obtuse (not obovate), yellow on both sides. Stamens 8 mm. long, reaching half-way up the perigone; filaments slightly shorter than the anther. Young capsule oblong-cylindric, getting thinner towards apex.

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[1] After Mr. Joseph Fernandez who, on several occasions, made valuable collections in Waziristan.

*Vernacular name*: Sundai, Shandi gul (Waziri).
*Locality*: *N.W.*: Hillside near Anghm village (Lt. Meynell 991a ! 999 !).
*S.W.*: On slope of Shuidar, 9,000-11,000 ft. (F. 1526 ! 1526a !).
*Flowers & young fruit*: 18-4-30. The snow had just disappeared from the locality.

**Tulipa porphyreo-chrysantha** Blatter *sp. nov.* [*Liliacea, persimilis Tulipae chrysanthae Boiss. sed distinguitur statura minore, foliis erectis variantibus,* 4-5, *phyllis perigonii exterioribus intus aureis, extus purpureis, interioribus aureis, absentia ad basim macularum brunnearum, staminibus longioribus perigonium dimidium attingentibus.*]

*Caulis cum pedunculo gracilis, ad* 13 *cm. altus, glaber. Folia* 4-5, *glauca, distantia, elongata, latitudine variantia erecta, lanceolata, lanceolato-linearia, lineari-acuminata, latiora undulata et margine cartilaginea, breviora vel longiora pedunculo. Flos mediocris unicus ad* 27 *mm. longus, erectus, campanulatus; phylla exteriora aurea intus, purpurea extus, oblongo-ellipsoidea, acuta vel breviter acuminata, interiora aurea, anguste obovata, obtusa. Stamina perigonio duplo breviora,* 13 *mm. longa, aurea filamenta aliquantulum antheris longiora vel iis aequilonga, glaberrima. Bulbum et fructum non vidi.*

Stem, including peduncle, up to 13 cm. high, glabrous. Leaves 4-5, glaucous, distant, elongate, varying in breadth, erect, lanceolate, lanceolate-linear, linear-acuminate, the broadest ones undulate with a cartilaginous margin, shorter or longer than the peduncle. Flower medium-size, 1, up to 27 mm. long, erect, campanulate; outer perigone-leaves golden-yellow inside, purple outside, oblong-ellipsoid, acute or shortly acuminate, inner ones golden-yellow, narrowly obovate, obtuse. Stamens reaching half-way up the perigone, 13 mm. long; filaments yellow, slightly longer than the anthers, glabrous. Bulb and fruit not seen.
*Vernacular name*: Shandi gul (Waziri).
*Locality*: *N.W.*: Hillside near Anghm village (Lt. Meynell 999 ! type, 999a ! cotype).
*Flowers*: April 1930.

### GAGEA Salisb.

30 species.—N. temperate regions of Old World.

**Gagea reticulata** Schult. f. Syst. vii, 542.
*Locality*: *N.W.*: N. of Dossali Fort, in stony nala, 4,900 ft. (B. & F. 1287 ! 1297 !).
*S.W.*: N. of Razmak, gravel plain, 6,750 ft. (B. & F. 49 !).
*Fruit*: 15-4-30 (Dossali).
*Distribution*: Afghanistan, Orient, S. Europe, N. Africa, Turkomania, Turkestan.

**Gagea reticulata** Schult. f. Syst. vii, 542 **var. tenuifolia** Boiss. Fl. Or. v, 208.
*Locality*: *N.W.*: Hills E. of Miram Shah, 3,600 ft. (B. & F. 577 !).—Spinwam, disintegrating limestone hill, 2,650 ft. (B. & F. 813 !).—Shewa Post, right bank of Kuram River (B. & F. 953 !).—E. of Miram Shah, gravel plain, 3,150 ft. (B. & F. 162 !).—N. of Dossali (B. & F. 1047 !).
*S.W.*: N. of Razmak, towards Springs, on gravel, 6,700-7,300 ft. (B. & F. 1782 !).—S.W. of Razmak on hill, 6,900 ft. (B. & F. 1944 !).
*Flowers*: 4-4-30 (Spinwam); 10-4-30 (Dossali).
*Flowers & Fruit*: 22-3-30 (E. of Miram Shah); 29-3-30 (E. of Miram Shah); 25-4-30 (Razmak).
*Distribution of var.*: Persia to Egypt.

**Gagea lutea** Schult. f. Syst. vii, 538.
*Locality*: *S.W.*: Razmak, on gravel and sand, 6,750 ft. (B. & F. 48 !).
*Flowers*: 20-3-30 (Razmak).
*Distribution*: W. Himalaya, westwards to the Atlantic, N. Asia.

**Gagea persica** Boiss. Diagn. ser. 1, vii (1846) 108 **var. ebulbillosa** Boiss. Fl. Or. v, 210.
*Locality*: *S.W.*: Razmak (B. & F. !).
*Distribution of var.*: Afghanistan, Baluchistan, Persia.

### COLCHICUM L.

45 species.—Europe, W. Asia, N. Africa.

**Colchicum luteum** Baker in Gard. Chron. (1874) 33.
*Locality*: *N.W.*: W. of Miram Shah, moist firm sand in old river-bed, 3,150 ft. (B. & F. 5 !).
*S.W.*: N. of Razmak towards Springs, on open stony ground, 6,700-7,300 ft. (B. & F. 1781 !, F. 1548 !).
*Fruit*: 19-3-30 (Miram Shah); 25-4-30 (Razmak); 10-5-27 (Razmak).
*Distribution*: W. temperate Himalaya, 4,000-7,000 ft., Afghanistan, Turkestan.

### MERENDERA Ram.

10 species.—Mediterranean, Abyssinia, Afghanistan.

**Merendera persica** Boiss. & Kotsch. Diagn. xiii, 37; Fl. Or. v, 169.
*Locality*: *S.W.*: Wana, 4,500 ft. (Duthie's Collect. 15662 !).—Razmak, 6,500 ft. (D. G. Lowndes F. 3 !).
*Flowers*: 4-5-1895 (Wana).
*Distribution*: Punjab, Salt Range, Afghanistan, Persia.

## JUNCACEAE.

300 species.—In damp and cold places, temperate and arctic regions, tropical mountains.

### JUNCUS.

225 species.—Cosmopolitan.

**Juncus glaucus** Ehrh. Beitr. vi, 83.
*Locality*: *S.W.*: Near Kaniguram (Stewart).—Wana (Duthie's Collect. 15668 !).
*Distribution*: W. Himalaya, 6,000-9,000 ft., from Kashmir to Nepal, Nilgiris, Ceylon, N. Asia, N. Africa, Europe.

**Juncus lampocarpus** Ehrh. Calam. no. 126.—*J. articulatus* L. Sp. Pl. i, 327.
*Locality*: *S.W.*: Near Kaniguram (Stewart).
*Distribution*: N.W. India, W. Himalaya, 7,000-14,000 ft., N. temperate regions.

## PALMAE.

1,500 species.—Tropical and subtropical regions.

### *PHOENIX L.

12 species.—Warm Africa, Asia.

***Phoenix dactylifera** L. Hort. Cliff. 482.
*Vernacular name*: Edible Date Palm; Khajura (Waziri); Shewa (Pu.).
*Locality*: *N.W.*: Miram Shah, cultivated (F. 801 !).
*S.W.*: Zam Valley above Khirgi, rare (Stewart).
*Tank* (Stewart).
*Distribution*: N. Africa, S.W. Asia, India.

### NANNORHOPS H. Wendl.

1 species.—N.W. India, Persia.

**Nannorhops Ritchieana** H. Wendl. in Bot. Zeit. (1879) 148.—*Chamaerops Ritchieana* Griff. in Calc. Journ. Nat. Hist. v, 342.
*Vernacular name*: Mazrai (Waziri); Maizurrye (Pu.); Pish, Mazari, Dhora (Baluch.).
*Locality*: *N.W.*: Boya (F. 423 ! 1464 ! 1520 !).—Miram Shah (F. 489 ! 1497 !).—Razani (F. 3015 !, Stewart).
*S.W.*: Sararogha (F. 177 ! 620 !).—Tenai Post (F. 4015 ! 4017 !).—Wana (F. 3414 !).—Between Sarwekai and Dargai Post on mountain (F.

3450 !).—Sarwekai (F. 3982 !).—On hills N. of Anai Gorge, abundant (Stewart).

*Flowers*: June 1927.

*Uses*: Used for making ropes, sandals and mats.

*Distribution*: Sind, Baluchistan, Waziristan, Punjab, Afghanistan.

## TYPHACEAE.

### TYPHA L.

12 species.—Temperate and tropical regions, in marshes.

**Typha angustata** Chaub. & Bory Exped. Scient. Moorée Bot. 338.

*Vernacular name*: Rukh (Pu.); Dilla (Waziri).

*Locality*: *N.W.*: Razani, in swamp (F. 2181 !).—Dwa Warkha (Stewart). *S.W.*: Jandola, along bank of Tank River (F. 763 !).—Sarwekai (F. 3907 !).—Tenai Post, along stream, on way to Spin (F. 4036 !).—Dargai Post, in marsh (F. 3738 !).—Wana, along river and in swamp (F. 3598 !). *Tank*: In ravine S. of Tank (Stewart).

*Flowers*: 25-5-27 (Jandola); 22-6-27 (Dargai Post).

*Distribution*: N. India from Kashmir to Manipur and southwards to Sind and Coromandel, N. Asia, N. Africa, S. Europe.

*Uses*: Leaves used for thatch at Tank and other places (Stewart).

## ARACEAE.

1,000 species.—Tropical and temperate regions.

### PISTIA L.

1 species.—Tropical and subtropical regions.

**Pistia Stratiotes** L. Sp. Pl. (1753) 963; Roxb. Corom. Pl. iii, 63, t. 269, Fl. Ind. iii, 131; Boiss. Fl. Or. v, 45.

*Locality*: *S.W.*: Razmak, 6,300 ft. (F. 1653 ! 1655 ! 1658 ! 2028 !).

*Distribution*: All the warm regions of the earth.

*Flowers*: April.

### ARISAEMA Mart.

105 species.—Asia, Abyssinia, N. America.

**Arisaema flavum** Schott. Prodr. (1860) 40.—*Arum flavum* Forsk. Fl. Aeg.-Arab. (1775), p. cxx, no. 525, 157.—Fruit scarlet.

*Locality*: *S.W.*: Razmak, at base of small bushes, plentiful, 6,500 ft. (Capt. Lowndes 8 !).

*Flowers & Fruit*: July 1932.

*Distribution*: Subtropical W. Himalaya, Simla, Garhwal, Afghanistan, Kuram Valley, Arabia, Abyssinia, Eritrea.

## LEMNACEAE.

18 species.—Free-swimming perennial water-plants.

### LEMNA L.

6 species.—Cosmopolitan.

**Lemna minor** L. Sp. Pl. 976.

*Locality*: *N.W.*: Boya, in Tochi River (F. 525 !).

*Distribution*: Cosmopolitan in temperate and tropical regions.

## ALISMACEAE.

75 species.—Cosmopolitan.

### ALISMA L.

1 species.—N. temperate regions, Australia.

**Alisma plantago** L. Sp. Pl. (1753) 342.

*Locality*: *S.W.*: Kaniguram (Stewart).—N. of Razmak, below Springs

7,700 ft. (B. & F. 1856 !).—Wana Plain, along stream (F. 3400 ! 3412 !).—E. of Wana Fort, in marsh (F. 3402 !).

*Flowers*: 18-6-27 (Wana).

*Distribution*: Lower Himalaya, 1,000-7,000 ft., from Kashmir to Manipur and Burma, N. and S. temperate regions.

SAGITTARIA Rupp. ex L.

33 species.—Temperate and tropical regions.

**Sagittaria sagittifolia** L. Sp. Pl. (1753) 993.

*Locality*: *S.W.*: Wana Plain, marsh (F. 3455 !).

*Distribution*: India, Afghanistan, Mesopotamia, Europe, N. Asia, N. America.

## POTAMOGETONACEAE.

120 species.—Cosmopolitan.

POTAMOGETON (Tourn.) L.

90 species.—Cosmopolitan.

**Potamogeton indicus** Roxb. Fl. Ind. i (1832) 452.

*Locality*: *S.W.*: Jandola, bed of Tank River (F. 749 !).—Wana, marsh (F. 3522 ! 3565 !).

*Flowers & Fruit*: 25-5-27 (Jandola).

*Distribution*: Throughout the plains of India, Ceylon, Malay and Sandwich Islands.

RUPPIA L.

1 species.—Temperate and subtropical regions.

**Ruppia maritima** L. Sp. Pl. (1753) 127.

*Locality*: *N.W.*: Boya, Tochi River (F. 524 !).—Miram Shah (F. 350 !).

*Fruit*: 7-4-27 (Boya).

*Distribution*: Europe, N. Africa, tropical Asia, N. America.

ZANICHELLIA Mich. ex L.

1 species.—Cosmopolitan.

**Zanichellia palustris** L. Sp. Pl. (1753) 669.

*Vernacular name*: Shan shabae (Waziri).

*Locality*: *N.W.*: Boya, Tochi River (F. 1419 ! 1421 !).—Miram Shah village, in a pond, 3,150 ft. (B. & F. 512 !).—Near Chasmai River, in muddy pool, 3,150 ft. (B. & F. 331 !).

*Flowers & Fruit*: 24-3-30 (Chasmai River); 27-3-27 (Boya).

*Distribution*: Cosmopolitan, except Australia.

*(To be continued).*

# THE HYDERĀBĀD STATE ORNITHOLOGICAL SURVEY.

BY

SÁLIM ALI.

With Notes by HUGH WHISTLER.

## PART V.

*(With three plates).*

*(Continued from page* 142 *of this Volume).*

### FAMILY: PANDIONIDÆ.

**Pandion haliaëtus** (Linn.) The Osprey.

*Falco haliaëtus* Linnæus, Syst. Nat., ed. x, vol. i (1758), p. 91—Europe, restricted to Sweden.

No specimen obtained.

A single bird (or birds?) was frequently observed at the junction of the Godāvari and Kinārsāni Rivers at Borgampād between 1 and 7 November. Col. Sparrow also has sight records from Bhiknūr, Hūssein Sāgar Tank (Hyderābād City) and elsewhere between 25 November and 10 March.

**Sarcogypus calvus** (Scopoli). The Black, Pondicherry or King Vulture.

*Vultur calvus* Scopoli, Del. Flor. et Faun. Insubr., vol. ii (1786), p. 85—Pondicherry.

No specimen obtained.

Noted at Manānūr, Borgampād, Nelipāka, Āsifābād, Kandahār, Deglūr, Kaulās and Kannad.

The Black Vulture is common everywhere, but not numerous. Two or three may invariably be seen in every vulture gathering at wayside carcases, and the density of their population relative to the other species probably bears the same ratio.

William Davidson (S.F., x) writes: 'I too have noticed what Jerdon says about the fear shown by *Gyps bengalensis* and *Gyps indicus* of this species'. It is curious that my experience has been quite the opposite. I have always found this so-called King Vulture to be the most cowardly member of the fraternity that usually gathers at a feast, keeping itself aloof of the scrimmage, only occasionally venturing forward in obvious fear and trembling to tug at a gobbet and withdrawing hurriedly when overwhelmed by the press. The photograph published with Part I of this paper (J.B.N.H.S., xxxvi, 368) depicts a King Vulture on the extreme left in its typically cowardly attitude.

*Breeding*: Col. Sparrow took a fresh egg at Navipēt (?) on 3-1-14 and found young at Rāmākapētt (?) on 31-1-14.

**Gyps fulvous** (Hablizl) subspecies? The Indian Griffon Vulture.

*Vultur fulvous* Hablizl, Neue Nord. Beytro., vol. iv (1783), p. 58—Mtns. of Gilan, N. Persia.

No specimen obtained.

Noted at: Manānūr, Nelipāka, Kandahār, Deglūr, Kaulās, Aurangābād, Ūtnoor, Hyderābād City and Environs, and elsewhere.

This is one of the commonest vultures, probably even more so than the White-backed species. At Daulatābād Fort (Aurangābād Dist.) numbers were observed on the cliffs at the base of the battlements, and this appeared to be an admirable nesting site. At the time, however, the birds were not breeding. (26 April).

**Gyps indicus** (Scopoli) subspecies? The Long-billed Vulture.

*Vultur indicus* Scopoli, Del. Flor. et Faun. Insubr., vol. ii (1786), p. 85—Pondicherry.

No specimen obtained.

Noted at: Manānūr, Kaulās, Ūtnoor and elsewhere.

Common, sharing the honours almost evenly as regards numbers with the White-backed Vulture, and present at every wayside carcase. Also observed at a panther's kill in deciduous forest.

*Breeding*: Col. Sparrow has taken eggs and young in various stages at Mūlkāram and Eswantarāopēt between 7 January and 16 March.

**Pseudogyps bengalensis** (Gmelin). The White-backed Vulture.

*Vultur bengalensis* Gmelin, Syst. Nat., vol. i (1788), p. 245—Bengal.

No specimens obtained.

Noted at: Manānūr, Borgampād, Pāloncha, Deglūr, Ūtnoor, Āsifābād, Kaulās, Hyderābād City Environs and elsewhere.

This common and familiar species is easily recognised by its white back and, in overhead flight, by the white bands across the underside of the wings.

Vultures certainly follow one another's movements when descending to a carcase. Some make a wide spiral descent while others just let themselves down through space more or less perpendicularly, wings half pulled in. The feet are always dropped dangling in descent and even when a bird is soaring high up in the heavens, such behaviour leaves no doubt as to its intentions. Before taking off from the ground they generally hop along for some distance against the wind, taking advantage of the resistance to lift them up. I have frequently observed that they will do so even if they have to turn right round and run into the face of the observer from whom they are fleeing.

*Breeding*: On 18 December (Āsifābād) a pair were observed in copula. During the act the birds (or female only ?) made a loud raucous grating noise very like a hoe being scraped over a cemented floor.

Col. Sparrow found nests with young at Kāmāreddi and Rāmākapētt on 28 January.

**Neophron percnopterus** (Linn.) subsp.? The White Scavenger Vulture.

*Vultur percnopterus* Linnæus, Syst. Nat., ed. x, vol. i (1758), p. 87—Egypt.

No specimens obtained.

Noted at: Hyderābād City and Environs, Nāgar Karnūl, Manānūr, Farāhābād, Borgampād, Āsifābād, Kandahār, Deglūr, Kaulās, Aurangābad, Kannad and elsewhere.

A common and abundant species usually met with on the outskirts of towns and villages either perched on roof-tops, rocks or stakes, or goose-stepping along the ground. Besides the human ordure on which it largely feeds, it is also invariably present in small numbers at wayside carcases, timidly tugging and pulling at odds and ends whenever the coast is clear.

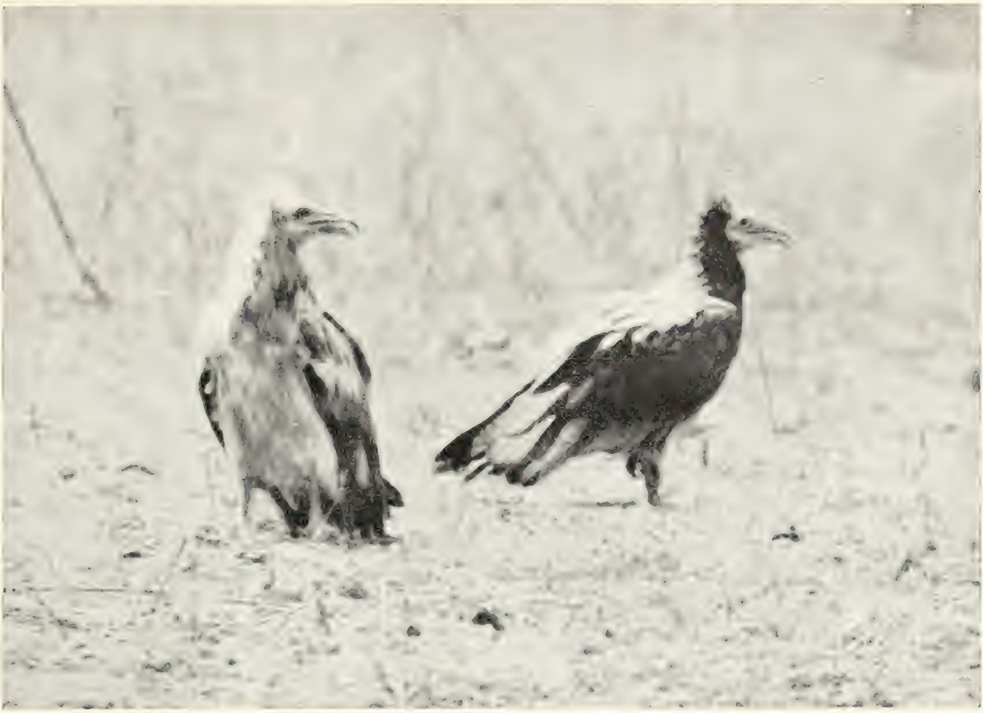
*Breeding*: On 26 March (Kaulās) a nest was located in a niche among the battlements of the ruined fort, containing two fairly hard-set eggs. They measured 61×49 and 66×54 mm. respectively. The nest was no more than a rough, flimsy and untidy pad composed of the most filthy and disreputable rags, goats' hair, dung (that looked like a hyaena's) and so forth. The parent was a close sitter and had to be moved with a stick, although it made no effort at defence subsequently. On 27 March a second nest was found in an identical situation not a hundred yards away, also a collection of the same filthy odds and ends. A fresh egg was lying smashed on a ledge about 5 ft. above the nest. On the same day a 3rd nest was discovered with the bird sitting on it, in an inaccessible niche in the ramparts at about 30 ft.

Col. Sparrow found several nests containing eggs and young (usually one or two) at Masāipēt, Trimulgherry, Eswantarāopet and elsewhere, between 20 February and 5 April. One egg on the last date was fresh.

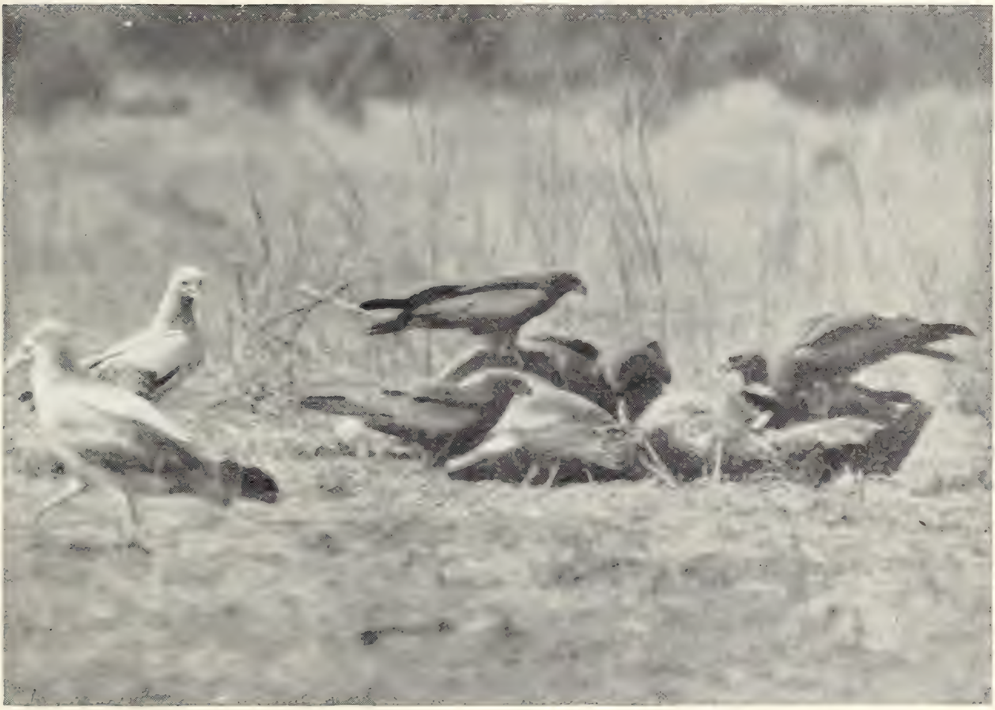
## FAMILY: FALCONIDÆ.

**Falco peregrinus** Tunstall. subsp.? The Peregrine Falcon.

*Falco peregrinus* Tunstall, Orn. Brit. (1771), p. 1—Great Britain.

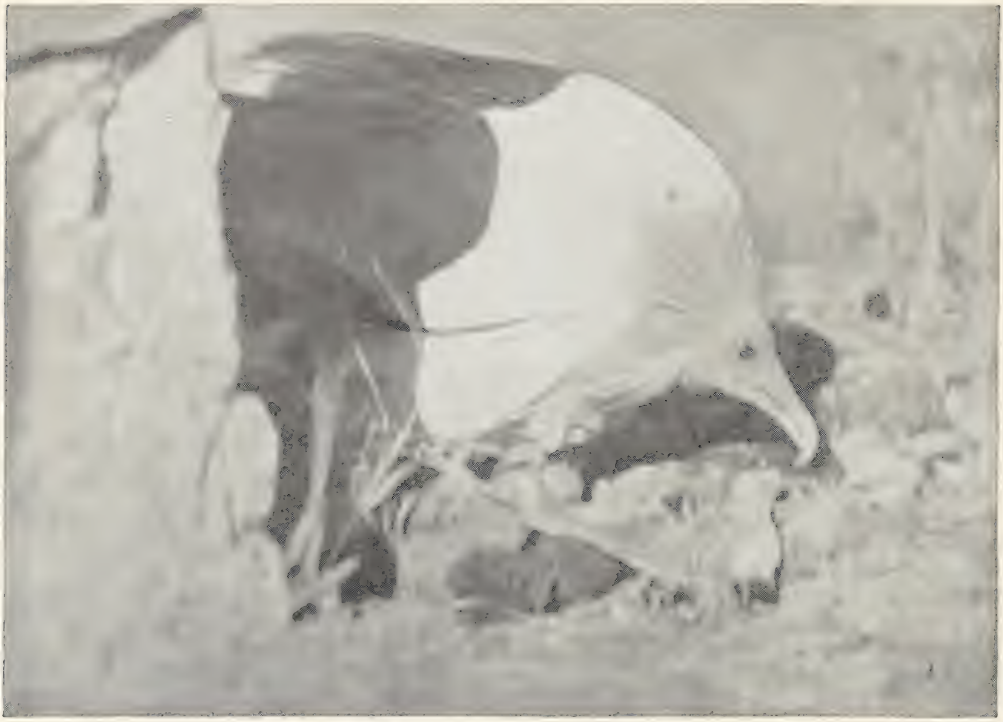


1. Scavenger Vultures (*Neophron percnopterus*).

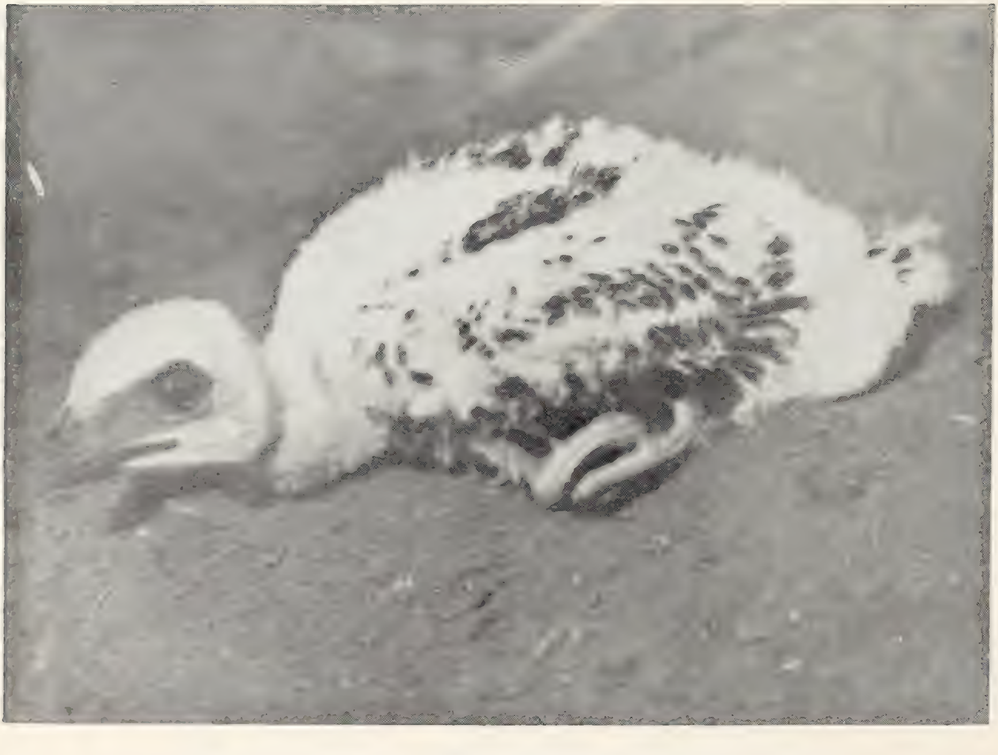


2. Pariah Kites (*Milvus govinda*) and Neophrons at a wayside carcase.

*Photos by Author.*



1. Scavenger Vulture on Nest (Kaulās, 26 March).



2. Downy Chick of the Crested Hawk-Eagle (*Spizaëtus cirrhatus*), Utnoor, 9 April (see description).

*Photos by Author.*

No specimens obtained.

One was noted at Borgampād on 28 October 1931. Col. Sparrow has a sight record of one at Chintakani on 3-2-13.

I do not mention other sight records as I cannot be certain of my identifications of this group of birds in the field.

**Falco jugger** J. E. Gray. The Lagar Falcon.

*Falco jugger* J. E. Gray in Hardwicke's Illust. Ind. Zool., vol. ii (April 1834), pl. 26—India.

Specimens collected: 214 ♂ 1-11-31 Borgampād 160 ft.; 543 ♂ 13-3-32 Deglūr 1,300 ft.

Noted elsewhere at: Kaulās (19 March).

Iris brown; cere and circumorbital skin pale greenish-yellow to bright lemon-yellow; corneous part of bill plumbeous, tip black; legs and feet greyish-yellow to bright yellow; claws horny-black.

Only seen singly or in pairs in the neighbourhood of cultivation. No. 214 and its pair were being mobbed by crows. It uttered from time to time a shrill prolonged cry *whi-ee-eee*. No. 543 was being chivvied by a pair of Black Drongos. Its stomach contained a field rat.

The testes of the specimens were in an undeveloped condition.

**Falco subbuteo** Linn. subsp.? The Hobby.

*Falco subbuteo* Linnæus, Syst. Nat., ed. x, vol. i (1758), p. 89—Europe, restricted to Sweden.

I did not observe this species in Hyderābād, but Cap. E. A. Butler records one shot near Jālna in his 'Tentative Catalogue of Birds in the Deccan and Southern Mahratta Country' (S.F., ix, 367-442) ca. 1881.

**Falco chiquera** Daudin. The Red-headed Merlin.

*Falco chiquera* Daudin, Traité d'Orn., vol. ii (1800), p. 121—Bengal.

No specimens obtained.

Noted at: Borgampād where a pair was worrying and chasing crows close to the village, and at Narsampēt—a solitary bird near a marsh.

Col. Sparrow saw it at Trimulgherry 6-11-12 and shot a ♂ at Jālna 21-1-11.

**Cerchneis tinnunculus tinnunculus** Linn. The Kestrel.

*Falco tinnunculus* Linnæus, Syst. Nat., ed. x, vol. i (1758), p. 90—Europe, restricted to Sweden.

Specimens collected: 182 ♀ 29-10-31, 215 ♀ 1-11-31, 216 ♂ 2-11-31, 227 ♀ (?) 3-11-31 Borgampād 160 ft.; 318 ♂ 15-11-31 Nelipāka 160 ft.

Elsewhere noted at: Narsampēt, Mālegāon (Mrs. Tasker !); Mūkhēr, Deglūr, Kaulās.

Iris dark brown; cere and circumorbital skin lemon yellow; bill greenish-horn, black at tips; mouth greyish pink or pale pink; legs and feet bright yellow; claws black.

The Kestrel was abundant in the cultivated country at Borgampād where it was commonly seen perched singly on mounds, stones or low bushes—sometimes on the ground—in the middle or on the edge of fields and ploughed land. The fields appear to be apportioned off among the birds, and encroachment on neighbouring 'feeding territories' meets with active resistance from the rightful owner. For some reason, the birds were less numerous at Nelipāka although the country seemed identical, and at the other places their numbers were considerably less. The stomachs of the specimens contained field rats and mice, besides locusts, grasshoppers and other insects.

The familiar hovering is always accomplished with the help of wind resistance, the bird invariably facing the wind to do so.

The gonads of the specimens gave no indication as regards breeding.

In the following I only mention such of the Eagles, of the identity of which I am positive. There is no doubt that many others must also occur within the limits of this vast tract of country, but I hesitate to mention unconfirmed sight records as these can obviously be of little scientific value. If the Hyderābād Survey is resumed, I hope to be able to pay greater attention to the Birds of Prey.

**Aquila rapax vindhiana** Franklin. The Indian Tawny Eagle.

*Aquila vindhiana* Franklin, P.Z.S. 1830-1831 (October 25, 1831), p. 114—Vindhyan Hills.

No specimens obtained by the Survey. Col. Sparrow shot two examples as follows: ♂ 9-2-11 Kārkeli (Deccan); ♂ 1-2-12 Trimulgherry.

Noted at: Borgampād, Kandahār, Kaulās, and elsewhere.

A common resident species.

At Kandahār a single individual came regularly round the camp to pick up carcases of skinned birds, and was constantly persecuted by rival kites and crows. At Kaulās one was observed picking up scraps left by vultures after a feast, in company with Scavenger and King Vultures.

*Breeding*: Col. Sparrow took a clutch of two eggs at Eswantarāopēt on 15 December (1913).

Davidson and Wenden (S.F., vii, 74) who found this eagle extremely abundant in the Deccan, took eggs from 28 October to 12 February.

B. Aitken (N. & E., iii, 135) found a nest in Akola (Berār) on 1 January containing a half-fledged chick. On 10 February, according to him, the same pair laid C/1 in a new nest.

**Hieraëtus fasciatus** (Vieillot). Bonelli's Eagle.

*Aquila fasciata* Vieillot, Mem. Linn. Soc., Paris, vol. ii (2), 1822, p. 152—Montpelier, France.

Not met with by the Survey.

*Breeding*: Col. Sparrow took a clutch of 2 eggs at Navipet (?) on 2 January (1914).

Davidson and Wenden (S.F., vii, 74) found a single newly hatched chick on 10 February, and took slightly set eggs on 13 January at Kassigaum (presumably in the Bhīma Valley, Deccan). They saw eyries with young also at Dhotri and Subjar.

**Spizaëtus cirrhatus cirrhatus** (Gmelin). The Crested Hawk-Eagle (Telūgū: *Namli-pūri-gadda*).

*Falco cirrhatus* Gmelin, Syst. Nat., vol. i, pt. i (1788), p. 274—India.

Specimens collected: 321 ? 15-11-31 Nelipāka 160 ft.; 375 ♀ 26-11-31 Pāloncha 300 ft.; 668 ♀ 7-4-32, 680 ♀ (juv.) Utnoor 1,250 ft.

Elsewhere noted at: Āsifābād.

Iris pale khaki to bright orange yellow, apparently varying with age; cere greyish to greenish-brown; corneous portion of bill horny-black; gape and eyelids greyish-green; feet lemon yellow; claws horny-black. *In nestling*: Iris greyish-brown; cere slaty-grey; bill horny-black; gape greenish-grey; bare skin round and in front of eyes, slaty-grey; mouth pink; feet pale greenish-grey; claws horny-black.

The Crested Hawk-Eagle is not uncommon in the forested tracts of the State. It has a loud high-pitched cry: '*Ki-ki-ki-ki-ki-ki-ki-ki-ki-keee*' beginning short, rising in a crescendo and ending in a scream.

The stomach of No. 321 contained a large lizard (*Calotes versicolor*), and the bird was exceedingly fat. According to the local Gonds, this species is very destructive to hares and young peafowl.

*Breeding*: No. 668 (7 April) was shot off a nest—a collection of sticks—in the fork of a straight Mhowa tree in deciduous forest, at a height of about 60 ft. Its ovaries were reverting to normal condition and a conspicuous incubation patch was present. The nest contained a chick in white fluffy down (No. 680). It was kept alive for two days on carcases of skinned birds, swallowing an entire Munia (*Amandava*) at a time. It also drank greedily. As far as I know the nestling of this eagle has not before been described. The following is a detailed description of No. 680: A thick rudimentary tuft of white down at nape, where crest in adult; brown primaries sprouting, also bastard wing quails, secondaries, upper wing-coverts, dark brown scapulars, upper tail-coverts and rectrices. A central tract of brown feathers down the back of the neck to midway between the scapulars, and two tracts of fulvous-brown feathers on either side of the breast.

The ♂ parent did not put in an appearance during the time the nest was being climbed up to and handled.

Col. Sparrow has taken 10 clutches of a single egg each in every stage of incubation, at Eswantarāopēt between 21 February and 3 May.

According to Vidal (N. & E., iii, 147) the Crested Hawk-Eagle breeds in South Konkan from December to April, during which time he examined 32 nests. The favourite month is said to be January. The species is not mentioned in D. & W's list for the Deccan.

**Circaëtus gallicus** (Gmelin). The Short-toed Eagle.

*Falco gallicus* Gmelin, Syst. Nat., vol. i, pt. i (1788), p. 259—France.

Not met with by the Survey.

*Breeding*: Col. Sparrow has taken 3 clutches of a single egg each, at Eswantarāopēt between 28 January and 20 February.

Davidson and Wenden (S.F., vii, 74) describe it as not uncommon in the bare parts of the Sholāpūr District from September to the beginning of April. They did not observe it breeding.

**Hæmatornis cheela** (Latham) subsp.? The Crested Serpent Eagle.

*Falco cheela* Latham, Index Ornith., vol. i (1790), p. 14—India.

Noted in the environs of Hyderābād City (25 September) and at Nelipāka (9 November). Apparently rather an uncommon species.

**Butastur teesa** (Franklin). The White-eyed Buzzard-Eagle.

*Circus teesa* Franklin, P.Z.S. 1830-1831 (25 October, 1831), p. 115—Between Calcutta and Benares and in the Vindhyan Hills between the latter place and Gurra Mandela.

Specimen collected: 99 ♂ 11-10-31 Manānūr 2,000 ft.

Elsewhere noted at: Borgampād, Narsampēt, Kandahār, Deglūr, Ūtnoor, Itchora, Kannad.

Iris pure China white; base of lower mandible bright yellow, rest of bill horny-brown; mouth pale pinkish; legs and feet bright yellow; claws black.

A commonly distributed species frequenting both open country and deciduous forest. At Borgampād it was commonly observed perched singly on small mounds or bush-tops in or about cultivation, while in the deciduous forest between Itchora and Utnoor it was noted as the commonest bird of prey.

The stomach of the specimen contained two large *Mabuia* (*carinata* ?) lizards, 1 locust (apparently *Acridium peregrinum*), 1 large green grass-hopper (species?) and remains of Katydids and other grasshoppers. There was also found a tangle of endoparasitic worms, sent for determination to the Berlin University Zoological Museum.

*Breeding*: The testes of the specimen (11 October) were in non-breeding condition. On 4 April a nest was located in the fork of a straight *Boswellia serrata* tree in deciduous jungle, at a height of about 25 ft. The owner was observed carrying a lizard to the nest which obviously contained young. Unfortunately it was inaccessible and could not be examined.

Col. Sparrow, who found this species very common in the jungles about Eswantarāopēt, has taken numerous clutches of eggs in varying stages of freshness and incubation between 30 March and 5 May. Most nests contained two eggs, but some had three and occasionally there was only one.

B. Aitken (N. & E., iii, 160) found it breeding in Akola (Berar). D. and W.'s Deccan list does not include this species.

**Haliastur indus** (Boddaert). The Brahminy Kite.

*Falco indus* Boddaert, Tabl. Pl. Enlum (1783), p. 25 for pl. Enl. 416—Pondicherry.

No specimens collected.

Noted at: Borgampād, Manānūr (7 February, Mrs. Tasker !), Deglūr, Kaulās, Ūtnoor, Kannad.

A fairly common species. Curiously enough I failed to meet it on the Amrābād Plateau between 3 and 21 October, though Mrs. Tasker who visited the place subsequently, in February, found it there. The Brahminy Kite moves about locally a good deal with the seasons, a fact well known to residents in Bombay and suburbs. In the Punjab also, Mr. Whistler has found it to be an almost entirely rains visitor.

*Breeding*: Col. Sparrow has 3 clutches of 2 eggs each taken at Mirzāpalli and Masāipet between 25 January and 19 February.

Davidson and Wenden (S.F., vii, 75) record it as rather rare in the Deccan. They shot a female on January 16 from a newly-built nest—no eggs—on the Bhima river which would have laid in about a week. Another nest on the Bhima River on 24 April contained 1 egg and 1 chick, and a third on 14 February on the Dew River (14 miles from Poona) one nestling. According to Vidal (N. & E., iii, 171) it breeds in South Konkan from the middle of January to the end of March. I found this to be the case in the Kolaba Dist. (N. Konkan) also.

**Milvus migrans govinda** Sykes. The Common Pariah Kite.

*Milvus govinda* Sykes, P.Z.S. 1832 (31 July, 1832), p. 81—Dukhun.

No specimens collected.

Noted at: Hyderābād City and Environs, Manānūr, Borgampād, Nelipāka, Kandahār, Deglūr, Kaulās, Ūtnoor, Aurangābād, Kannad, Vijāpūr (1924).

An ubiquitous species in open country, especially in the neighbourhood of towns and villages. Large assemblages were sometimes seen on marshy ground bordering tanks etc. in the vicinity of Manānūr. Pariah Kites are invariably present in some numbers at wayside carcases in company with vultures, and about slaughter-houses, wherever they may be.

*Breeding*: The first pair observed in copula was on 7 November (Nelipāka), while as late as 14 April two nests were noted on large tamarind trees near the weekly bazaar square in Aurangābād with birds sitting on them, obviously brooding.

Col. Sparrow took seven clutches of two eggs each in varying stages of incubation at Trimulgherry, between 8 November and 6 March.

In the Bhīma Valley (Deccan) it breeds freely from the middle of September to the middle of March (Davidson and Wenden, S.F., vii, 75.)

**Elanus cœruleus** (Desfontaines). The Black-winged Kite.

*Falco cœruleus* Desfontaines, Hist. (Mem.) Acad. Paris 1787 (1789), p. 503, pl. 15—Algiers.

No specimens obtained.

Noted at: Kandahār and Deglūr only. Col. Sparrow has seen it at Alwal and Masāipet.

This little Kite was met with singly in open country about cultivation. Its flight consists of slow and deliberate wing-beats reminiscent of the Blue-Jay (*Coracias*).

Capt. J. H. Yule (N. & E., iii, 179) describes it as very common about Poona, where he took eggs in June, July, August, September and October and found a nest with young on 2 February.

In the Sholāpūr District, Davidson (N. & E., iii, 180) considered it the commonest bird of prey. He found many nests with young and also many fledged young in April, and again with eggs in the last week of June. Davidson and Wenden (S.F., vii, 75) record it as moderately common in the Bhīma Valley. They took C/3 on 10 July and state that it breeds abundantly in December in Caladgi District, some 50 miles from Sholāpūr.

**Circus macrourus** (S. G. Gmelin). The Pale Harrier.

*Accipiter macrourus* S. G. Gmel., Nov. Comm. Acad. Petrop., vol. xv (1771), p. 439, pl. viii, ix—Woronecz to River Don, Russia.

Specimen collected: 356 ♂ 23-11-31 Pāloncha 300 ft. Col. Sparrow obtained the following: ♀ 2-1-11, ♂ 14-2-11 Dichpalli; ♂ 21-2-11 Medchal.

Elsewhere noted at: Kaulās (20 March), Pārtūr (31-1-11, Col. Sparrow !).

Iris bright lemon yellow; bill horny-black; cere and gape yellowish-green; legs and feet bright yellow; claws black.

The Pale Harrier was usually seen skimming over standing fields of jowari and rice and low scrub jungle, perching now and again on clods, mounds and the like. The stomach of the specimen contained a field-mouse.

Its testes were in a quiescent state.

I do not give other sight records owing to the uncertainty of the species to which they refer.

**Circus pygargus** Linnæus. Montague's Harrier.

*Circus pygargus* Linn., Syst. Nat., ed. x, vol. i (1758), p. 89—England.

Specimens collected: 363 ♀ 24-11-31 Pāloncha 300 ft.; 539 ♀ 12-3-32 Deglūr (both imm.) 1,300 ft. Col. Sparrow shot one at Wadiārum ♂ (juv.) 16-12-10.

Haunts and habits same as the foregoing.

Iris brown; cere lemon yellow, base of lower mandible and gape greenish grey, rest of bill horny black; mouth bluish-slate; legs and feet bright ochre yellow; claws black.

No. 539 (12 March) was very fat suggesting that it was preparing to emigrate. Its stomach contained a field-mouse and 1 large locust, apparently *Acridium peregrinum*. The ovaries of both were undeveloped.

**Circus æruginosus** (Linnæus). The Marsh Harrier.

*Falco æruginosus* Linn., Syst. Nat., ed. x, vol. i (1758), p. 91—Sweden.

No specimens obtained by the Survey. Col. Sparrow procured the following: ♂ 16-1-13 Medohil (Madhol ?); ♂ ad. 9-2-13 Kupra (?); ♂♀ 9-11-13 Chintakani Tank.

Noted at: Narsampēt, Pākhāl.

The Marsh Harrier was seen in the neighbourhood of tanks and marsh land, skimming on motionless wings close over the reed beds or water-logged fields, and dropping now and again on some unwary frog, lizard or snake.

**Astur badius dussumieri** (Temm.). The Shikra.

*Falco dussumieri* Temm., Planch. Color. d'Ois (1824), livr. 52, pl. 308—Bengal.

Specimens collected: 604 ♀ 24-3-32, 612 ♂ 26-3-32 Kaulās 1,350 ft.; 716 ♂ 18-4-32 Kannad 2,000 ft.

Elsewhere noted at: Hyderābād City and Environs, Manānūr, Farahābād, Kandahār, Ūtnoor, Aurangābād.

Iris bright orange, reddish-orange or orange-scarlet; cere yellow, rest of bill slaty-grey, blackish on culmen; legs and feet yellow; claws black.

The Shikra is a resident, commonly distributed and familiar little hawk throughout the State. It affects gardens, mango and tamarind groves and open deciduous forest, but preferably keeps to the neighbourhood of villages and cultivation. Its usual call notes are exactly like those of the Black Drongo only somewhat louder. Near villages they are very destructive to young chickens. The stomach of No. 604 contained a field mouse, apparently *Mus buduga*.

*Breeding*: No. 604 (24 March) had the ovaries enlarged, the largest follicle measuring 4 mm. in diameter. Judging from the oviduct, the bird had apparently not laid yet, but it was one of a pair who had a nest in a leafy mango tree in the grove where we were encamped. No. 612 (25 March) was observed carrying a twig in its feet into the leafy top of a large tamarind tree in the village precincts, where it was building. Its testes were in breeding condition, measuring 16×7 mm. No. 716 (18 April), evidently also breeding, had testes 14×6 mm. The birds were very noisy at this time, and pairs were frequently observed indulging in curious aerial antics. The note commonly uttered at this, the breeding season, was a sharp double *ti-tui*.

Col. Sparrow took many clutches of the Shikra's eggs, usually 1 to 3, at Bezwādā, Eswantarāopēt and elsewhere in the State, between 4 April and 2 June.

Davidson and Wenden (S.F., vii, 73) found this species common in the Bhīma Valley at all seasons. They took C/2 (fresh) on 31 March. In Akolā (Berār) it breeds in May and June (B. Aitken, N. & E., iii, 121).

**Accipiter nisus** (Linn.) subspecies? The Sparrow-Hawk.

*Falco nisus* Linnæus, Sys. Nat., ed. x, vol. i (1758), p. 92—Sweden.

Not met with by the Survey. Col. Sparrow has a sight record from Masāipet 3-12-13.

**Pernis ptilorhynchus ruficollis** Lesson. The Indian Crested Honey-Buzzard.

*Pernis ruficollis* Lesson, Traité d'Orn. 1830, p. 77—Locality unknown= Bengal.

Specimen collected: 585 ♀ 21-3-32 Kaulās 1,350 ft.

Elsewhere noted at: Manānūr and Narsampēt.

Iris bright yellow; bill horny-black, greyer at base of lower mandible; legs and feet dirty yellow; claws horny-black.

[According to the Key to the species of Pernis (F.B.I., 2nd ed., vol. v, p. 165)—'black subterminal and median bands much narrower than the paler ones'—the specimen would fall under *Pernis apivorous*. As D'Abreu has pointed out, however (J.B.N.H.S., xxxv, 219), birds from the Central Provinces with the above characteristics are *P. p. ruficollis*. The Key therefore needs amending. The wing of the specimen measured 444 mm.]

The Crested Honey-Buzzard is not uncommon in the well-wooded tracts of the State, where it was frequently observed soaring in circles high above the forest, usually singly but sometimes in pairs. In flight the rounded tail, cross-barred black and white, and the similarly but more closely barred undersurface of the wings is conspicuous. The call uttered in flight is a high-pitched, short scream-like whistle, quickly repeated. It has also a single prolonged note *whee-ee-eew* which I have only heard when the bird is perched on some tree-top.

A large quantity of honey dripped from the bill of the specimen when held up by its legs, and its stomach contained a greenish honey-scented mass. Its ovaries gave no positive indication as regards breeding, though the follicles were distinctly granular and appeared to be enlarging.

*Breeding*: Col. Sparrow has taken the following eggs: C/1 5-4-13, C/1 6-6-14 (both fresh). Eswantaräopēt; C/2 (hard set) 8-6-14 Kāmāreddi.

Davidson and Wenden (S.F., vii, 75) found this species rather rare about Sholāpūr. They saw a pair breeding on 6 February and state that the birds were very noisy.

## ORDER: COLUMBÆ.

## FAMILY: COLUMBIDÆ.

**Crocopus phœnicopterus chlorigaster** (Blyth). The Southern Green Pigeon. (Telūgū: *Pacha-polka*).

*Vinago chlorigaster* Blyth, J.A.S.B., vol. xii (1843), p. 167, note—no locality =South India.

Specimens collected: 74 ♂ 9-10-31 Manānūr 2,000 ft.; 320 ♀ 15-11-31 Nelipāka 160 ft.

Elsewhere noted at: Farāhābād, Borgampād, Pāloncha, Narsampēt, Pākhāl Lake, Kaulās, Ūtnoor.

Iris outer ring pink, inner bright lapis blue; bill pale French grey, basal portion including cere greenish; mouth greyish-pink (greyish-yellow in 320); legs and feet bright chrome yellow; claws French grey.

Common throughout the forested tracts of the State and also found sparingly in the opener portions where they come long distances to gorge themselves on the ripe figs of *Ficus bengalensis*, *F. religiosa*, *F. glomerata* and others. They are likewise partial to ripe Ber (*Zizyphus oenoplia*) and *Bridelia Hamiltoniana* berries. I found this Green Pigeon most abundant in the deciduous forest round Narsampēt, the total prohibition of shooting and snaring in this area, which is H. E. H. the Nizam's *Shikārgāh*, doubtless being mainly responsible for their abundance. Flocks of 30 to 50 birds were common in this locality, while often they were much larger.

The birds have a remarkable capacity for studiedly obliterating themselves among the foliage of a tree as if they were conscious of the camouflage afforded them by their plumage. When a tree is approached, the birds promptly get out of the skyline, become silent and motionless having got behind the foliage in such a cunning manner that while the body may be fully exposed, looking for all the world like a leaf among the leaves, the concealed head will be watching the movements of the intruder through some tiny opening between the leaves! It is only with the help of powerful field glasses that these manoeuvres can be followed.

The gonads of the specimens were in an undeveloped condition.

Davidson and Wenden (S.F., vii, 86) write: 'Observed but rarely about Sholāpūr. Commonest at Lanoli and Egutpoora. Nests taken on the Satāra Hills where it is not uncommon, in March. Observed at Nulwar'.

**Muscadivora æenea sylvatica** (Tickell). The Imperial Green Pigeon.

*Columba sylvatica* Tickell, J.A.S.B., vol. ii (November 1833), p. 581—Borabhum.

Specimen collected: 162 ♂ 18-10-31 Farāhābād 2,800 ft.

Elsewhere noted at: Nelipāka and Pāloncha. Also at Kamlāpūr near Sironcha (Col. Sparrow 6-6-12 !).

Iris crimson; eyelids magenta; bill horny-grey, magenta at base of upper mandible and on culmen; mouth pinkish-grey; legs and feet magenta; claws dusky-horn.

The Imperial Green Pigeon is confined to forests, in my experience only in the eastern and southern portions of the State. Numbers collect to feed on the various Fici and other trees when in fruit, but ordinarily they are mostly met with singly or in pairs. Occasionally small parties of three or four birds are seen.

The crop and stomach of the specimen contained figs of *Ficus glomerata*, *F. bengalensis* and *F. religiosa* exclusively. The gape and gullet in this species is remarkably capacious and elastic. When opened out to the full they were large enough, in the specimen, to accommodate a sour lime 1½ in. in diameter without difficulty.

The testes of the specimen were in non-breeding condition.

**Chalcophaps indica** (Linnæus). The Bronze-winged or Emerald Dove.

*Columba indica* Linnæus, Syst. Nat., ed. x, vol. i (1758), p. 164—India.

No specimens obtained.

Only once seen at Pāloncha (19 November) as a solitary bird in thick scrub undergrowth in deciduous forest.

**Columba livia intermedia** Strickland. The Blue Rock Pigeon.

*Columba intermedia* Strickland, Ann. Mag. Nat. Hist., vol. xiii (January 1844), p. 39—India.

Specimen collected: 412 ♂ 2-12-31 Narsampēt 800 ft.

Elsewhere noted at: Amrābād Plateau, Kandahār, Kaulās, Ellora Caves, Daulatābād Fort. Also Hyderābād City and Environs and other towns in the Dominions, here probably a mixed breed.

Iris orange; bill brownish-black, cere powdery greyish-white; legs and feet magenta; claws brownish-black.

These pigeons were met with in flocks of 10-15 birds, usually on or about rock scarps, ruined forts etc. where they nested in holes and on ledges.

*Breeding*: The specimen (2 December) had well-developed elongate testes 22 mm. long. It was one of a pair nesting in a hollow in the decaying trunk of a *Borassus* palm in scrub country, at a height of about 20 ft. The bird was clinging to the outside of the hollow somewhat like a woodpecker.

**Columba elphinstonii** (Sykes). The Nilgiri Wood-Pigeon.

*Ptilinopus elphinstonii* Sykes, P.Z.S. 1832 (November), p. 149—Nilgiris.

No specimens obtained.

I got just a glimpse of a pigeon in the forest round Manānūr (at the foot of the Mahēswara Plateau) which may have been this species.

According to the *Fauna* (2nd. ed., vol. v, p. 229) Col. Sykes obtained this pigeon in the 'Deccan Ghats', where it was rare. The exact locality is unspecified.

**Streptopelia orientalis** (Latham). The Rufous Turtle-Dove.

*Columba orientalis* Latham, Index. Orn., vol. ii (1790), p. 606—China.

No specimens obtained.

A single bird was seen in dense hill forest at Kaulās (23 March). It has a deep guttural *Coo*.

Davidson and Wenden (S.F., vii, 86) found this dove common in Satāra and neighbouring hills.

**Streptopelia chinensis suratensis** (Gmelin). The Indian Spotted Dove. (Telūgū for all doves: *Gooā*).

*Columba suratensis* Gmelin, Syst. Nat., vol. i, pt. ii (1789), p. 778—Surat.

Specimen collected: 169 ♂ 18-10-31 Farāhābād 2,800 ft.

Elsewhere noted at: Hyderābād City and Environs, Manānūr, Borgampād, Nelipāka, Pāloncha, Pākhāl Lake, Āsifābād, Kandahār, Kaulās, Ūtnoor, Kannad, Bhāmarvādi.

Iris pale reddish-brown; eyelids dull crimson; legs and feet bright magenta; claws brown.

The Spotted Dove is generally distributed throughout the Dominions, inhabiting both open country (with or without cultivation) and deciduous forest. The density of its numbers, however, varies considerably in different localities. At Pāloncha for instance it was noted as the commonest dove both inside and out of forest, while on the other hand it was comparatively rare at Kandahār, Aurangābād and Kannad where its numbers were conspicuously lesser than any of the other three species, namely *Streptopelia risorius, S. cambayensis* and *Œnopopelia tranquebarica*. On the whole I found it much less common in the opener and drier districts of the Mahrattwāda than in the forested portions of the Telingāna.

*Breeding*: The testes of the specimen (18 October) were in non-breeding condition. On 25 September, however, a nest was located in a garden at Saifābād (Hyderābād City)—the usual flimsy platform of twigs—about 8 ft. up in a Nīm tree containing two eggs which the parent was brooding.

On 4 April (Ūtnoor) a partially fledged young, just out of nest, was observed.

Col. Sparrow has taken eggs at Trimulgherry between 31 October and 9 May. It is common in Sholāpūr during the rains (D. & W., S.F., vii, 86).

**Streptopelia senegalensis cambayensis** (Gmelin). The Little Brown Dove.

*Columba cambayensis* Gmelin, Syst. Nat., vol. i, pt. ii (1789), p. 779—Cambaya.

Specimen collected: 482 ♀ 18-12-31 Āsifābād 1,200 ft.

Elsewhere noted at: Hyderābād City and Environs, Jedcherla, Achampēt, Nāgar Karnūl, Manānūr, Borgampād, Pāloncha, Āsifābād, Kandahār, Kaulās, Nīrmal, Aurangābād, Kannad, Bhāmarvādi.

Iris brown; eyelids pale magenta; bill brownish-black; legs and feet magenta; claws like bill.

The Little Brown Dove is an inhabitant of open country and cultivation and eschews forest. Thus it was absent at Farāhābād and Ūtnoor, while at Āsifābād and elsewhere, although met with in open country and cultivation on the *fringe* of forest, it was never actually within. It loves the boulder hillock country such as obtains in the environs of Hyderābād City and Hanamkōnda and was also noted as very partial to the thick patches of *Opuntia* scrub on the outskirts of Aurangābād town.

*Breeding*: The ovaries of the specimen were in non-breeding condition. The following records of nests were obtained:

(1) 15 March (Deglūr). On rafter in verandah of inhabited bungalow, 9 ft. up. Bird brooding.
(2) 22 March (Kaulās). In bush at 18 in. from ground, scrub jungle. 2 eggs measuring 26×18 and 24×18 mm.
(3) 25 March (Kaulās). In fork of low tree at about 3 ft., open deciduous forest. 2 eggs.
(4) 25 March (Kaulās). In bush at about 2 ft., open deciduous forest. 2 eggs.
(5) 27 March (Kaulās). In niche in wall of ruined fort, a few feet distant from nest of Scavenger Vulture. 2 eggs.
(6) 29 March (Nīrmal). In bush in borrow-pit by motor road at 4 ft. 2 eggs.
(7) 12 April (Nīrmal). On stone ledge in ruined fort wall at 5 ft. 2 eggs.

(8) 16 April (Kannad). In Karonda bush bordering dry nullah at 5 ft.; open scrub and cultivated country. No eggs yet.

The injury feigning habit when its nest is approached suddenly and without warning, is a common feature with this bird.

Col. Sparrow has taken eggs of this species at Trimulgherry between 12 April and 28 August. It is common throughout the Sholāpūr District, and breeds (D. & W., S.F., vii, 86). B. Aitken found a nest on the ground in Berar in November (N. & E., ii, 353).

**Streptopelia risorius** (Linnæus). The Indian Ring Dove.

*Columba risoria* Linnæus, Syst. Nat., vol. i (1766), p. 285—India.

No specimens obtained.

Noted at: Jedcherla, Achampēt, Nāgar Karnūl, Manānūr, Borgampād, Pāloncha, Āsifābād, Kandahār, Kaulās, Ūtnoor, Aurangābād, Kannad, Bhāmarvādi.

The Ring Dove is another common member of this group which has a general distribution in Hyderābād. I, however, failed to meet it at Farāhābād and noted that in wooded country as at Utnoor, Āsifābād and elsewhere it was markedly less abundant than the Spotted Dove.

It is a bird primarily of open cultivated country interspersed with patches of Babool or *Butea,* into the foliage of which it can retire in the hotter parts of the day, emerging again to feed at about three in the afternoon. In the neighbourhood of Borgampād it has been recorded as the most numerous of the doves.

*Breeding*: Col. Sparrow has taken eggs at various places in the Deccan in all months between 11 January and 26 August except June and July.

**Œnopopelia tranquebarica** (Herman). The Indian Red Turtle-Dove.

*Columba tranquebarica* Herman, Observ. Zool. (1804), p. 200—Tranquebar.

No specimens obtained.

Noted at: Hyderābād City and Environs, Borgampād, Kandahār, Nīrmal (1925).

This species appears to be rather patchily distributed in our area. With the exception of Borgampād, and perhaps Kandahār, it was nowhere common, its numbers even at these places being far less than any of the other doves. It is usually seen singly or in pairs feeding in the mornings and afternoons in company with other doves in freshly-sown jowari fields etc. It retires into shady trees during the heat of the day.

*Breeding*: Col. Sparrow has records of eggs from various places in the Deccan for January, February, March and November.

## ORDER: PTEROCLETES.

### FAMILY: PTEROCLIDÆ.

**Pterocles indicus** (Gmelin). The Painted Sandgrouse.

*Tetrao indicus* Gmelin, Syst. Nat., vol. i, pt. ii (1789), p. 755—Coromandel Coast.

Specimens collected: 275 ♀, 276 ♂ 9-11-31 Nelipāka 160 ft.; 598 ♂ 23-3-32 Kaulās 1,400 ft.

Elsewhere noted at: Ūtnoor, Bhāmarvādi.

Iris brown; bill orange-brown; naked skin round eye pale yellowish-green; hind (unfeathered) portion of tarsus and feet dull yellow or greyish leaf-green; claws brownish-orange to dark brown.

Met with in small numbers in parties of 5 or 6 birds, but more often pairs, on open stony patches in the midst of thick deciduous or scrub jungle. The birds were not abundant anywhere, but in the country round Ūtnoor two or three pairs were frequently flushed in the course of a morning's collecting. Pairs were usually observed coming down to drink at a rocky pool in a nullah-bed as late as 6-50 p.m. when dusk had well set in. This seems to be a regular habit as it was also noted at Kaulās on several occasions. The stomachs and crops of Nos. 275 and 276 contained grass seeds and some small berries.

*Breeding*: The organs of Nos. 275 and 276 (9 November) shot from a small flock of 5 or 6 birds, were undeveloped, but the testes of 598 (23 March), one of a pair, appeared to be enlarging. They measured 5×3 mm. From now onwards also, the birds were seen almost invariably in pairs.

Col. Sparrow found nests and eggs in thin jungle about Eswantaraōpēt as follows: 1 in January, 1 in February, 2 in March, 3 in April and 3 in May.

**Pterocles exustus erlangeri** Neumann. The Common Indian Sandgrouse.

*Pterocles exustus erlangeri* Neumann, Orn. Monatsb. 1909, p. 154—Lahadj, S. Arabia.

Specimen collected: 459 ♀ 13-12-31 Āsifābād 1,200 ft.

Elsewhere noted at: Nelipāka, Pāloncha, Kandahār, Mūkhēr, Kaulās, Vijāpūr.

Iris dark brown; eyelids greenish yellow; bill horny-plumbeous; feet and claws greyish-brown.

The Common Sandgrouse was usually met with in small flocks of 4-15 birds on fallow-land, stubble country or newly ploughed fields. At Mūkhēr a great many of these parties were observed coming to drink in relays at a sandy stream, and at Deglūr at a tank, at about 8-30 in the mornings.

*Breeding*: The ovaries of the specimen gave no indication as regards breeding.

Col. Sparrow has taken 2 fresh eggs at Omri (?) Deccan on 8-2-11, and found 4 nests containing young, about a fortnight old, at the same place on 16-2-14.

## ORDER: GALLINÆ.

### FAMILY: PHASIANIDÆ.

**Pavo cristatus** Linnæus. The Common Peafowl.

*Pavo cristatus* Linnæus, Syst. Nat., ed. x, vol. i (1758), p. 156—India.

No specimens collected.

Noted and/or shot at: Manānūr, Farāhābād, Nelipāka, Āsifābād, Kaulās, Utnoor, Bhāmarvādi.

The Peafowl is common in all afforested tracts within the State and was usually met with in flocks of 6 or 7 birds. They were particularly abundant at Utnoor in the forest about Arti-Margoo, where they regularly trooped down to drink at pools in the rocky stream-bed between 7 and 9 in the mornings and again at about 5-30 p.m.

*Breeding*: On 16 October a flock containing besides adults, 3 or 4 young slightly larger than a fair-sized Orpington hen, were observed at Farāhābād. The condition of the gonads of 4 specimens shot on 5 April (Utnoor) was as follows: (1) testes enlarged to 24×12 mm. (2 & 3) ovarian follicles ca. 3 mm. in diameter (4) immature; ovaries undeveloped.

Col. Sparrow took a clutch of 4 hard-set eggs by the Indravati River (C.P.) on 23-5-12.

**Gallus sonneratii** Temminck. The Grey Jungle Fowl.

*Gallus sonneratii* Temm., Pig. & Gal., vol. ii (1813), p. 246—India.

Specimens not collected.

Noted and/or shot at: Manānūr, Farāhābād, **Nelipāka, Pāloncha, Narsampēt**, Āsifābād, Utnoor.

♂ Iris orange-brown; bill horny-brown, commissure and lower mandible paler (yellowish); legs and feet yellow; spurs horny-brown.

The Grey Jungle Fowl is common in the afforested portions of the State where it affects scrub jungle in the vicinity of cultivation. It is usually met with in small parties, but the cocks often detach themselves and keep singly. At Manānūr and Farāhābād their crowing was one of the commonest jungle sounds early in the mornings and at dusk, sometimes even continuing till almost pitch dark. It is generally uttered from the top of an ant-hill, stone or fallen log and is not invariably preceded by a flapping of wings. The birds roost at night up in a bamboo clump or in trees.

Berries picked up from under the bushes, especially those of *Zizyphus œnoplia*, are eaten to a very large extent, and these birds are doubtless responsible to a considerable degree for the dissemination of the seed of this plant.

A cock shot on 6 October (Manānūr) was moulting primaries, secondaries and neck-hackles. Another, an immature bird, on 9 November was moulting primaries and secondaries.

*Breeding*: On 14 November (Nelipāka) several family parties consisting of parents and 3-5 young were observed. The young were about three-quarters grown and from analogy with domestic birds would be 2-3 months old.

**Galloperdix spadicea** (Gmelin). The Red Spur-Fowl.

*Tetrao spadiceus* Gmelin, Syst. Nat., vol. i, pt. ii (1789), p. 759—Madagascar *errore* = Nilgiris.

No specimens obtained.

Noted at Manānūr, Farāhābād and Utnoor in bamboo forest and on rocky deciduous hillsides with thorny scrub, usually in pairs.

**Galloperdix lunulata** (Valenciennes). The Painted Spur-Fowl.

*Perdix lunulata* Valenciennes in Levrault's Dict. Sci. Nat., vol. xxxviii (1826), p. 446—Bengal.

Specimens collected: 568 ♂ 18-3-32, 617 ♀ 26-3-32 Kaulās 1,350 ft.

Elsewhere not noted.

Iris hazel brown; bill horny-brown, paler at chin; legs and feet greyish olive-brown; claws and spurs horny-brown.

This beautiful Spur Fowl was not uncommon in the above locality. It was usually seen in pairs in rocky, broken scrub-country or on hillsides. It is a good runner and reluctant to leave the ground unless hard-pressed or fired at, when it arises for a few yards but settles down again to continue the run.

*Breeding*: No. 568 was in fresh plumage, but its testes were undeveloped. In 617 (26 March) the ovary was mature, the largest follicle measuring 13 mm. in diameter. From the distended condition of the oviduct, moreover, it was evident that she was laying.

Col. Sparrow found several nests with eggs—usually 3, occasionally 4—in varying stages of incubation, among the small rocky hillocks at Eswantarāopēt between March and August, mostly in May.

**Coturnix coturnix coturnix** (Linnæus). The Common or Grey Quail.

*Tetrao coturnix* Linnæus, Syst. Nat., ed. x, vol. i (1758), p. 161—Sweden.

Specimens shot (not preserved): 22-11-31 Pāloncha 300 ft.; 20-3-32 Kaulās 1,350 ft.

I found the Grey Quail to be rare in Hyderābād State, the above being the only two occasions when it was come across—singly in *tooar* fields.

**Coturnix coromandelicus** (Gmelin). The Black-breasted or Rain Quail.

*Tetrao coromandelicus* Gmelin, Syst. Nat., vol. i, pt. ii (1789), p. 764—Coromandel.

Specimens collected: 519 ♀ 7-3-32 Mūkhēr 1,400 ft.; 540 ♂ 13-3-32 Deglūr 1,350 ft.

Elsewhere noted and/or shot at: Kandahār, Kaulās, Utnoor.

Iris orange-brown; bill horny-grey, dusky on culmen; legs, feet and claws pale yellowish flesh-colour.

Though met with rather more frequently than the preceding, this species was also nowhere really common or abundant. It was usually found in pairs, less often coveys of 6-8 birds, in grassland, gram-fields or in and about cut jowari fields.

The specimens were in fresh plumage, but their organs were in a quiescent condition.

**Perdicula asiatica** (Latham). The Jungle Bush Quail.

*Perdix asiatica* Latham, Index Orn., vol. ii (1790), p. 649—Mahratta region.

Specimens collected: 310 ♂ 14-11-31 Nelipāka 160 ft.; 386 ♂ 30-11-31 Nrasampēt 800 ft.; 541 ♀ 13-3-32 Deglūr 1,400 ft.; 654 ♂ 5-4-32, 658 ♂ 6-4-32 Utnoor 1,250 ft.

Elsewhere noted at: Borgampād, Pāloncha, Kandahār, Kaulās, Aurangābād.

Iris pale brown to orange-brown; bill blackish-brown on upper mandible, grey on lower mandible and at base of commissure; mouth greyish-pink; legs and feet dusky orange-yellow; claws flesh colour.

Whether the Jungle and Rock Bush Quails are really two different species or races, or whether they are merely dimorphic forms of the same species is a question that still remains to be settled. I am uncertain about their respective distributions in Hyderābād and also cannot be sure if I ever saw the two forms associating in one and the same covey as has recently been suggested. The professional snarers recognise two forms or 'species', examples of which I was shown. What is known to them as *Lowwa* I found was *P. asiatica,* whereas *Girja* was *P. argoondah.* I was told that round Manānūr both forms occurred in the same terrain which necessitated the employing of both species of decoys or call-birds.

Bush Quails (along with partridges, bustard and hares) are largely netted in the Hyderābād State by Pārdīs and other professional snarers, often with complete disregard as to season, with the result that many areas have been more or less completely denuded of such game while in others the process of decimation is in full swing. Unfortunately even officials and vakils, and people who should know better, aid and abet in this work of destruction either directly by commissioning the snarers to snare for them for special occasions, or indirectly by purchasing birds brought to the bazaars for sale out of season. I once came across a party of snarers on the outskirts of Aurangābād town in the second half of April, and learnt that they had been commissioned to snare Bush Quails for a military 'bara saheb' in the British Cantonments who was giving a dinner party the next day!

In the list of close seasons given at the end of the Hyderābād Game Regulations—for the infringement of which there is a penalty prescribed—I find no reference to Quails at all. Surely this does not mean that quails may be shot or netted all the year round? It is an oversight that demands speedy rectification if it is desired that quails should not completely disappear from the State. However, even with statutory protection, unless there is at the same time a ruthless enforcement of the game laws it is unlikely that much can be achieved.

*Breeding*: On 10 October (Manānūr) I found a nest at the base of a small plant in a grassy patch in scrub jungle. It was a shallow depression lined with grass and contained 6 pure white eggs. The owner could not be secured so it is doubtful to which form it belonged.

The testes of No. 310 (14 November) were enlarged to 11×7 mm. and it was one of a pair, while those of No. 386 (30 November), also one of a pair, were sufficiently developed to suggest breeding. In the rest of the specimens the gonads were in a quiescent state.

The wing and tail quills of No. 654 had the curious appearance of being clipped!

At Trimulgherry, Col. Sparrow took several clutches of up to 6 eggs between 24 August and 26 March.

*P. asiatica* is common in the hills of Satāra and Nulwar according to Davidson and Wenden (S.F., vii, 87).

In Salsette I have seen chicks in down on 19 April (1925, Trombay Hill) and Mr. Prater obtained a similar chick in December at Andheri (1923).

**Perdicula argoondah** (Sykes). The Rock Bush-Quail.

*Coturnix argoondah* Sykes, P.Z.S. 1832 (22 November), p. 153—Dukhun.

No specimens obtained by the Survey, but the following in Col. H. R. Baker's Collection, all from Aurangābād, have been examined by Mr. Whistler and found to belong to this form: ♀ 14-3-07, ♂ 21-3-07, ♂ 9-6-07, ♀ 29-8-09, (♂) 9-9-09.

According to Davidson and Wenden (S.F., vii, 87) *P. argoondah* is very common and breeds in the Bhīma Valley, Deccan. At Oomraotee in Berār also, J. Aitken found it very common and breeding in November and December, while at Sholāpūr Davidson says it does so in the latter part of the rains (N. & E., iii, 441-442).

**Francolinus pictus** (Jardine and Selby). The Southern Painted Partridge.

*Perdix picta* Jardine and Selby, Illust. Orn., pl. 50 (1828)—Bangalore.

Specimen collected: 581 ♂ 19-3-32 Kaulās 1,300 ft.; Col. Baker's Coll. contains ♂ 16-9-09 Aurangābād.

Elsewhere noted and/ or shot at: Hyderābād City Environs, Manānūr, Farāhābād, Narsampēt, Āsifābād, Kandahār, Mūkhēr, Utnoor, Itchora, Kannad.

Iris orange-brown; bill horny-black; legs and feet brownish-orange; claws horny-brown.

Widely distributed, in small numbers, all over the State but confined to well-watered patches where it keeps to the vicinity of streamlets, water channels and grassy water-logged ground. In the rains they move about a great deal locally, so that they may then be met with in places where there are none in the drier months.

The males have a habit of mounting stones or fallen logwood etc., bunds separating fields or isolated trees standing amidst them, and uttering their familiar far-reaching and often curiously ventriloquistic call; *Chick . . . cheek, cheek, keraykek* (or as the Emperor Bāber syllabified it; *Shīr dārem shakarek* !) mostly in the mornings up to 11 and then from 3 onwards right up to dusk. During the hottest parts of the day they are mostly silent.

*Breeding*: The testes of the specimen were in non-breeding condition.

Col. Sparrow found nests with 3 and 5 eggs respectively on 1 and 30 August (1912) at Trimulgherry, and 2 nests with 5 fresh eggs each at Bezwāda on 6-3-12.

Davidson and Wenden (S.F., vii, 87) describe the Painted Partridge as common in the Deccan (Bhīma Valley) and breeding in September. At Oomraotee in Berār it breeds in the Monsoon, most eggs being found in August and September (J. Aitken, N. & E., iii, 430).

The statement on p. 409, vol. v of the F.B.I., Birds (2nd edition), that Col. Sparrow found *Francolinus f. asiæ* common near Trimulgherry is most certainly erroneous. As far as I am aware no material is available to support the assertion that this species occurs as far south as Hyderābād. The Survey definitely failed to meet with it in the State.

**Francolinus pondicerianus pondicerianus** (Gmelin). The Grey Partridge.

*Tetrao pondicerianus* Gmelin, Syst. Nat., vol. i, pt. ii (1789), p. 760—Pondicherry.

Specimens collected: 703 ♀ 17-4-32 716 ♂ 18-4-32 Kannad 2,000 ft.; the Baker Coll. has: ♂ 17-2-07, ♀ 20-2-07 Aurangābād.

Elsewhere noted and/ or shot at: Hyderābād City Environs, Manānūr, Borgampād, Pāloncha, Narsampēt, Āsifābād, Kandahār, Mūkhēr, Kaulās.

Iris brown; bill horny-brown, paler at gape and base of lower mandible; legs and feet dusky coral red; claws brown.

[All the above specimens are clearly intermediate between *pondicerianus* and *interpositus*, but on the whole closer to the former.—H. W.]

The Grey Partridge is a common bird in Hyderābād State though owing to ceaseless and indiscriminate persecution, its numbers during recent years have been steadily on the decline in a great many areas. It frequents scrub jungle in the neighbourhood of fields. At Borgampād and Nelipāka a favourite haunt was the dense growth of *Vitex negundo* and other bushes bordering the Godāvari River whence they emerged into the adjacent jowari fields to feed.

I noted this species as absent at Utnoor between 1 and 10 April.

*Breeding*: A bird shot on 24 March (Kaulās) was half grown (apparently 1 or 2 months old) just undergoing complete moult into adult plumage. It was one of a brood of 4 in the company of parents. On 17 April (Kannad) a pair were noted accompanied by two young somewhat smaller than the above, while another pair, the next day, also had in attendance a couple of chicks of approximately the same age. In No. 703 (17 April—parent of the young recorded) the ovaries were reverting to non-breeding condition whereas No. 716 (18 April) accompanying the 3rd brood, still had enlarged testes measuring 13×8 mm.

The breeding season is apparently far from well-defined. The statutory close season, 1 March to 30 September, which unfortunately is nowhere very strictly observed, perhaps meets the requirements in a general way, but under a properly organised scheme of game protection it might in addition prove advisable to prohibit *netting and snaring* altogether and at all seasons in different areas by rotation until such time as they become sufficiently re-stocked.

A highly placed Hyderābād Police Officer, who was also a keen sportsman and Nature-lover, expressed his views as follows: 'The man with the gun does not do half so much damage as the snarer. The latter is like a broom for he sweeps everything before him into his net, old and young, male and female'. According to him a further factor in the depletion was the taking of eggs of ground game by herd-boys and the like. This of course should be made penal.

According to Davidson and Wenden (S.F., vii, 87) the Grey Partridge breeds in the Bhīma Valley in March and again during the rains. In Berār J. Aitken (N. & E., iii, 436) found it breeding in the beginning of the year. He took C/6 in February.

## ORDER: HEMIPODII.

### FAMILY: TURNICIDÆ.

**Turnix suscitator taigoor** (Sykes). The Common Bustard Quail.

*Hemipodius taigoor* Sykes, P.Z.S. 1832 (November), p. 165—Dukhun.

Specimens collected: 299 ♂ 12-11-31 Nelipāka 160 ft.; 616 ♂ 26-3-32, 619 ♀ 27-3-32 Kaulās 1,350 ft.

Elsewhere noted and/ or shot at: Manānūr, Pāloncha, Hanamkōnda.

Iris creamy white or China white; bill bluish-grey, blackish on culmen; legs and feet pale grey or greyish-white; claws dusky.

The Bustard Quail is widely distributed in Hyderābād but is nowhere abundant, being met with in pairs, rarely 3 or 4 together. It frequents scrub jungle and is partial to foot-paths or firelines, flanked with short grass and scrub, into which it comes out to feed.

Either the male or the female (probably the latter—but of this I am not positive) produces a loud drumming sound *Dr-r-r-r-r-r* and so on, which I have sometimes heard continued for over 15 seconds at a stretch. I have also heard this up to 10 o'clock on a pitch dark night. It is apparently a signal to other birds denoting the whereabouts of the producer, as frequently when a pair is disturbed and the birds fly off in different directions, one of them presently begins to drum.

*Breeding*: Only in No. 616 (26 March) did the gonads show any tendency towards development. Its testes measured ca 5×3 mm. and from the fact that the specimen was in perfect fresh plumage it is likely that it was preparing to breed.

On 12 October (1928—Hanamkōnda) I found a nest containing 3 fresh eggs off which the parent bird (male) was shot. There was no depression or lining; the eggs lay on the bare ground with a few blades of the short growing grass bent over to form a rough flimsy bower. The eggs were greyish-buff in colour with reddish-brown spots and speckles. The nest was situated in a patch of scraggy grass in light scrub jungle.

At Kihim (Kolāba Dist.—North Konkan) I shot a female on 25 July which had a hard-shelled egg in its oviduct ready for laying.

Davidson and Wenden (S.F., vii, p. 87) found the Bustard Quail scattered sparingly all over the Sholāpūr District, and breeding there.

## ORDER: GRALLÆ.

### FAMILY: RALLIDÆ.

**Porzana pusilla pusilla** (Pallas). The Eastern Baillon's Crake.

*Rallus pusillus* Pallas, Reise Russ. Reichs., vol. iii (1776), p. 700—Dauria.

Specimen collected: 392 ♀ (imm.) 30-11-31 Narsampēt 800 ft.

Elsewhere not noted.

Iris bright orange; bill leaf-green, brownish on culmen; legs and feet greyish-green; claws dusky.

The specimen—a solitary bird—was flushed in a thick swampy reed-bed at the edge of a tank, where it lay very low.

Its skull had an unossified patch in the centre.

**Amaurornis phoenicurus** (Pennant). The Chinese White-breasted Water-hen.

*Gallinula phœnicurus* Pennant, Ind. Zool. (1769), p. 10, pl. ix—Ceylon.

Specimen collected: 192 ♂ 29-10-31 Borgampād 160 ft.

Elsewhere noted at: Narsampēt, Kaulās.

Iris damaged; bill sage-green, reddish on forehead and at base of culmen; legs and feet brownish sage-green; claws brown.

Met with among bushes and undergrowth in the neighbourhood of village tanks, streamlets or water channels, singly or in pairs. Though an extremely noisy bird in the breeding season, it was now silent.

The testes of the specimen were undeveloped and it was undergoing heavy general moult.

According to Davidson and Wenden (S.F., vii, 90) the White-breasted Waterhen is tolerably common in the Bhīma Valley, Deccan. They found 5 nests at Nulwar in July.

**Gallinula chloropus** (Linnæus). The Indian Moorhen.

*Fulica chloropus* Linnæus, Syst. Nat., ed. x, vol. i (1758), p. 152—England.

No specimens collected.

Noted at: Narsampēt, Kandahār, Utnoor, Dornakal.

Fairly common on lotus-covered tanks where they run about on the floating leaves in search of insects and water bugs. They are also good swimmers. The birds were particularly numerous at Utnoor.

**Porphyrio poliocephalus** (Latham). The Indian Purple Moorhen.

*Gallinula poliocephala* Latham, Suppl. Index. Orn. (1801), p. 68—India.

No specimens collected.

Noted at Narsampēt and Utnoor where the birds were not uncommon on lotus and reed-covered tanks.

*Breeding*: Col. Sparrow found 3 nests at Navipēt on 26-8-14 with 8, 5 and 4 eggs respectively, and one at Madaram on 30-11-13 with 2 eggs.

**Fulica atra** Linnæus. The Coot.

*Fulica atra* Linn., ed. x, vol. i (1758), p. 152—Sweden.

No specimens collected.

Several birds were observed on tanks at Narsampēt, Kandahār and Deglūr. Last seen on 14 March (1932).

*Breeding*: On 11-8-14 Col. Sparrow found 3 nests and on 14-8-14 1 nest at Navipēt containing 10, 8, 2 and 7 eggs respectively, while 2 nests at Eswantarāopēt on 29-8-14 held 8 and 4 eggs each.

## FAMILY: JACANIDÆ.

**Metopidius indicus** (Latham). The Bronze-winged Jacana.

*Parra indica* Latham, Index. Orn., vol. ii (1790), p. 775—India.

No specimens collected.

Noted at: Nelipāka, Narsampēt, Utnoor.

The Bronze-winged Jacana was invariably present on lotus-covered tanks in the above localities, tripping gingerly over the large floating leaves.

Curiously enough the breeding biology of this common bird is almost unknown. Field work is necessary to determine, for instance, the significance of the fact that females are so much bigger than males, a condition different to that obtaining in the generality of birds of the same and allied families.

**Hydrophasianus chirurgus** (Scopoli). The Pheasant-tailed Jacana.

*Tringa chirurgus* Scopoli, Del. Flor. et Faun. Insubr., vol. ii (1786), p. 92—New Guinea *errore* = Philippines.

No specimens collected.

Noted at: Kāzipēt, Dornakal, Borgampād, Narsampēt and Utnoor.

A fairly common species being, like the above, present on every lotus-covered tank. The long and slender toes are most beautifully adapted for progression over floating vegetation. The weight of the bird is so well distributed by their means that not a ripple shows as it skips lightly from one leaf to another. At the season under reference they kept in flocks.

*Breeding*: Col. Sparrow found nests at Bāsar on 10 and 11 August 1914, containing 3, 4 and 2 eggs respectively.

### SUB-ORDER: ROSTRATULÆ.

### FAMILY: ROSTRATULIDÆ.

**Rostratula benghalensis benghalensis** (Linn.). The Painted Snipe.

*Rallus benghalensis* Linn., Syst. Nat., ed. x, vol. i (1758), p. 153—Asia.

Specimen collected: 432 ♀ 7-12-31 Pākhāl Lake 800 ft.

Elsewhere noted at: Utnoor.

Iris dark brown; bill pale horny-brown; legs and feet greenish-grey; claws dark brown.

The Painted Snipe is, in my experience, not a common species in Hyderābād. The specimen was one of the only pair seen on marshy savannah land close to the lake, while at Utnoor also it was met with in very small numbers among reedy marshes bordering tanks.

The ovaries of the specimen were in a quiescent state.

Davidson and Wenden (S.F., vii, 89) describe this species as common at all seasons in the Deccan (Bhīma Valley) and believe that it breeds there.

### SUB-ORDER: GRUES.

### FAMILY: GRUIDÆ.

**Anthropoides virgo** (Linnæus). The Demoiselle Crane.

*Ardea virgo* Linnæus, Syst. Nat., ed. x, vol. i (1758), p. 141—'In Oriente'.

Not met with by the Survey.

These Cranes visit many parts of the State in large flocks during the cold weather to feed on ripening gram and wheat crops to which they cause a certain amount of damage.

Personally I have only come across and shot them at Vijāpūr in the Aurangābād District (1925).

They also visit the Bhīma Valley in the cold weather in immense flocks (D. and W., S.F., vii, 88).

### SUB-ORDER: OTIDES.

### FAMILY: OTIDIDÆ.

**Choriotis nigriceps** (Vigors). The Great Indian Bustard.

*Otis nigriceps* Vigors, P.Z.S. 1830-31 (March 2, 1831), p. 35—Himalayas.

Not met with by the Survey.

This magnificent bird, known in Hyderābād as Toqdār or Tughdār is found to my knowledge in the Aurangābād, Parbhani and Nānder Districts. I shot two males in fresh adult plumage on 20 October (1924), at Vijāpūr (Aurangābād District). The birds frequented open scanty grass country or waste land interspersed with scrub and bushes, in the neighbourhood of cultivation, and were then in widely separated pairs. They were extremely wary, but permitted a close approach in a bullock-cart. The wing expanse of one was 87½ inches.

They are said to be fairly numerous still in remoter areas, but almost shot out in some of their former haunts now made easily accessible by means of cars and motor buses.

Davidson and Wenden (S.F., vii, 87) write: 'Common and breeds. It is very much more common during the rains and cold season than at other times'. This relates principally to the Bhīma Valley—Deccan.

## ORDER: CHARADRIIFORMES.

### SUB-ORDER: OTI-LIMICOLÆ.

### FAMILY: ŒDICNEMIDÆ.

**Burhinus œdicnemus** (Linnæus). The Stone Plover.

*Charadrius œdicnemus* Linn., Syst. Nat., ed. x, vol. i (1758), p. 151—England.

No specimens collected.

Noted at: Nelipāka, Utnoor.

The Stone Plover was met with on several occasions at Nelipāka frequenting heavy thorn-scrub country, either singly or in widely scattered pairs. Being of crepuscular habits, they usually came out at dusk to feed in open spaces in the scrub jungle, and small flocks of 5 or 6 were observed at such times.

At Utnoor, only a single pair was seen on broken, stony ground in sparse deciduous forest.

**Esacus recurvirostris** (Cuvier). The Great Stone Plover.

*Œdicnemus recurvirostris* Cuvier, Règne Anim., ed. ii, vol. i (1829), p. 500—India.

Specimen collected: 281 ♂ 9-11-31 Nelipāka 160 ft.

Elsewhere noted at: Borgampād.

Iris lemon yellow; sides of bill at base including gape and base of lower mandible bright chrome yellow, entire culmen and rest of bill black; legs and feet greenish-grey; claws black.

The Great Stone Plover was present in small numbers, either singly or in small parties of 3 or 4 on the Godāvari and Kinārsāni Rivers, where they kept to the mudspits and sandbanks. The carriage of the body in flight is peculiarly arched, while the round white patch on the primaries is then rendered conspicuous. The birds are good runners, and when wounded the specimen also swam with ease and swiftness, riding the water very like a duck.

Its testes were undeveloped. The stomach contained small crabs and other crustacea exclusively.

Col. Sparrow found nests with eggs—one or two—in various stages of freshness and incubation on the Godāvari River at Bezwāda between 12 and 14 February (1914), and large young on 22-3-14.

### SUB-ORDER: LARO-LIMICOLÆ.

### FAMILY: GLAREOLIDÆ.

### SUB-FAMILY: CURSORIINÆ.

**Cursorius coromandelicus** (Gmelin). The Indian Courser. (Telūgū: *Chītwa*).

*Charadrius coromandelicus* Gmelin, Syst. Nat., vol. i, pt. ii (1789), p. 692—Coromandel Coast.

Specimens collected: 259 ♀, 260 ♂ 6-11-31 Borgampād 160 ft.; 557 ♂ 15-3-32 Deglūr 1,400 ft.

Elsewhere noted at: Āsifābād, Mūkhēr, Kandahār, Kaulās, Kannad.

Iris dark brown; bill horny-brown; mouth greyish-pink; legs and feet dirty China-white; claws dark brown.

The Indian Courser is a fairly common bird in the State, about cultivation, especially where this lies in the midst of open scrub country. It was met with singly or in pairs or small flocks of 6-8 birds and was partial to freshly ploughed fields. Its habit of running a few yards, halting abruptly and raising itself high, and then again resuming the run for a few yards further, is distinctive.

The stomachs of the specimens contained grubs, beetles, grasshoppers and crickets.

*Breeding*: The testes of No. 557 (15 March) measured 7 × 5 mm. and appeared to be developing, and the bird was in freshly moulted plumage. The gonads of the other two specimens gave no indication as regards breeding.

The Indian Courser breeds abundantly about Sholāpūr in April, May, June, July and August, chiefly during May and June (Davidson and Wenden, N. & E., iii, 323-4).

**Rhinoptilus bitorquatus** Blyth. Jerdon's Courser.

*Macrotarsius bitorquatus* Blyth, J.A.S.B., vol. xvii (1), 1848, p. 254—Eastern Ghats.

Not met with by the Survey.

I scoured the country for miles both at Borgampād and at Nelipāka, and investigated every likely patch in search of this elusive creature; my shikaris (urged by promises of reward) and myself, were constantly on the look-out for it all through my stay at these two camps, but without success. Borgampād and Bhadrāchalam (near where Blanford obtained his specimens) are on either bank of the Godāvari River and lie almost directly opposite each other. It is therefore either that the birds move about with the seasons and I was looking for them at the wrong time, or that they have disappeared from the face of the earth altogether! Inspite of special effort, the Eastern Ghats Survey also failed to come across this species in Cuddapah and Nellore (where Jerdon first discovered it) or indeed anywhere else in the areas worked by them. It would be interesting to know what the last authentic record of its being shot or seen is.

The Telūgū name given in the Fauna, namely '*Adava-wuttu-titti*' was as great a mystery to the local Telūgūs as the bird itself, and one would like to know how it was come about!

## SUB-FAMILY: GLAREOLINÆ.

**Glareola lactea** Temminck. The Small Indian Pratincole or Swallow-Plover.

*Glareola lactea* Temm., Man. d'Orn., 2nd ed., vol. ii (1820), p. 503—Bengal.

Specimens collected: 221 ♀, 222 ♀, 223 ♀ 2-11-31 Borgampād 160 ft.

Elsewhere not noted.

Iris dark brown; bill black; gape orange-brown; mouth pink; legs, feet and claws black.

These little Plovers were common on the Godāvari and Kinārsāni Rivers in flocks of upto 30 or 40 birds, either feeding or resting on the sandbanks or flying up and down the rivers.

I frequently observed them hawking winged insects in the twilight, after sunset, over an open patch of waste-land on the banks of the Godāvari, in company with Palm Swifts, both close to the ground (30 or 40 ft.) and higher up in the air. The flight and movements of the birds in this quest were exactly like those of a pipistrelle bat, and they stopped short, and turned and twisted in the air with the same agility and complete mastery. Their flight and actions were indeed so similar that in the case of the higher flying individuals it needed special attention to distinguish them as birds!

The stomachs of the specimens contained crustaceans and hymenopterous insects.

*Breeding*: The ovaries in each case were in a quiescent state.

Col. Sparrow collected 10 clutches of 1-4 fresh eggs each (some doubtless incomplete), at Bezwāda between 21 and 22 March 1913.

Davidson and Wenden (S.F., vii, 88) found these birds common on the Bhīma River in the cold weather.

## FAMILY: STERNIDÆ.

**Sterna aurantia** Gray. The Indian River Tern.

*Sterna aurantia* Gray, Illust. Ind. Zool., vol. i, pl. 69, fig. 2 (1831)—India.

Specimens not collected.

A tern seen about the junction of the Godāvari and Kinārsāni Rivers at Borgampād, in company with the next, was presumably this species. Its numbers were considerably less than those of the Black-bellied Tern.

*Breeding*: Col. Sparrow took a clutch of 3 fresh eggs and another of 2, on 6-3-12 at Bezwāda (Madras Presidency), and 3 more clutches (fresh) at the same place on 22-3-13. In the Central Provinces he found 2 hard set eggs on 19-5-12 on the Indravati River and notes that by that time the majority of young had flown.

**Sterna melanogaster** Temminck. The Black-bellied Tern.

*Sterna melanogaster* Temm., Planch. Color., pl. 434 (1827)—Ceylon.

Specimens collected: 217 ♀, 218 ♀, 219 ♂ 2-11-31 Borgampād 160 ft.

Elsewhere not noted.

Iris dark brown; bill, mouth, legs and feet bright orange; claws black.

The Black-bellied Tern was common on the Godāvari and Kinarsāni Rivers, often in large flocks, resting on the sandbanks and islets or flying to and fro over the water. When one bird drops to the shot two or three others immediately follow suit and plunge down almost instinctively with him. This is a familiar trait with other terns as well. I suggest that the birds do so because they think their companion has darted down at some food. After a couple of circles overhead, and on discovering the real cause, the other birds gradually move off.

I have frequently watched these Terns skimming slowly over the surface of the water against wind, taking advantage of the resistance as described under the Swallow (*Hirundo rustica*).

*Breeding*: The gonads of the specimens were in an undeveloped condition, and they were in varying stages of complete moult.

Col. Sparrow has taken several clutches of 1-3 eggs (mostly 3) at Bezwāda between 26 February and 7 April. He found a brood of 3 young, about 7 days old, on the Indrāvati River (Central Provinces) on 18 May (1912).

## FAMILY: RHYNCHOPIDÆ.

**Rhynchops albicollis** Swains. The Indian Skimmer.

*Rhynchops albicollis* Swainson, Anim. in Menag. (1838), p. 360—India.

Not met with by the Survey.

The Skimmer probably occurs in the Hyderābād State on the larger rivers such as the Godāvari and Krishna.

Col. Sparrow found it breeding at Bezwāda in the Madras Presidency and on the Indrāvati River in the Central Provinces, and took eggs in varying stages of freshness and incubation between 6 April and 19 May, by which latter date the majority of young had flown. The earliest date on which he saw flying young was 21 March (1913—Bezwāda).

## SUB-ORDER: LIMICOLÆ.

## FAMILY: CHARADRIINÆ.

## SUB-FAMILY: CHARADRIINÆ.

**Charadrius dubius jerdoni** (Legge). The Little Ringed Plover.

*Ægialitis jerdoni* Legge, P.Z.S. 1880 (June 1st), p. 39—Ceylon.

Specimens collected: 545 ♀ 14-3-32 Deglūr 1,300 ft.

Elsewhere noted at: Borgampād, Malkāpūr (along Nālgonda Road), Mūkhēr, Kandahār.

Iris brown; eyelids bright yellow; bill horny-brown, yellow at base of lower mandible; legs and feet yellow; claws brown.

A fairly common species but usually met with in small numbers—pairs or small parties of 5-7, occasionally more—frequenting the edges of tanks and shingly stream beds.

In most of its haunts the Ring Plover presents a remarkable example of protective colouration, and inspite of the white underparts it is often quite impossible to pick out a bird from its surroundings even at such short range as 10 or 15 yards, until it moves.

I noticed curious behaviour in the case of one of these birds feeding on marshy ground. At every step where no insect or crustacean was disturbed, the bird put out one of its feet slightly forward and 'drummed' with the toes on the soft mud with a rapid vibratory motion. In almost every case I could see it darting at something immediately after. I went up to the spot and tried the same manoeuvre with a piece of stick and discovered that this tapping really had the effect of dislodging a number of insects, sand-hoppers and tiny crabs lurking in holes in the mud. I have been able to confirm this observation several times subsequently and it has also been independently confirmed by my brother Mr. Hamid Ali. This appears to be a regular habit with the species.

Mr. Whistler points out that the habit of stamping on mud has been noted with Gulls in England, and recently also in America (Auk, April 1934, p. 234).

*Breeding:* The ovaries of the specimen were undeveloped. It was undergoing heavy body and tail moult, the remiges being fresh.

Col. Sparrow took clutches of 3 fresh eggs each at Bezwāda on 14 February (1914) and 20 March (1913). Another C/3 was on the point of hatching on 8 April (1913).

**Pluvialis dominicus fulvus** (Gmelin). The Golden Plover.

*Charadrius fulvus* Gmelin, Syst. Nat., vol. i, pt. ii (1789), p. 687—Tahiti.

Specimen collected: 183 ♂ 29-10-31 Borgampād 160 ft.

Elsewhere not noted.

Iris dark brown; bill greenish-black; legs and feet greenish-grey.

Several flocks of 15 to 20 birds were observed in or about ploughed and freshly-sown jowari or partially inundated fields, in the neighbourhood of the Godāvari River.

The testes of the specimen were undeveloped.

[This is probably the bird which Fairbank records as *Squatarola helvetica*, 'Dakhan: in flocks in the cold weather' (S.F., iv, 262)—H. W.].

## SUB-FAMILY: VANELLINÆ

**Hoplopterus duvaucelii** (Lesson). The Spur-winged Plover.

*Charadrius duvaucelii* Lesson in Levrault's Dict. Sci. Nat., xlii (1826), p. 38—Calcutta.

Specimen collected: 194 ♂ 30-10-31 Borgampād 160 ft.

Elsewhere not noted.

Iris dark brown; bill black; wing-spurs horny-black; legs and feet greenish slaty-black.

These birds were present in small numbers on the sandbanks of the Godāvari and Kinārsāni Rivers, especially about their junction. They kept in small parties of 3 or 4 individuals.

The testes of the specimen were in normal non-breeding condition.

**Lobivanellus indicus** (Boddaert.). The Red-wattled Lapwing.

*Tringa indica* Boddaert., Tabl. Pl. Enlum, p. 5 on Pl. Enl. 807 (1783)—Goa.

Specimens not collected.

Noted at: Hyderābād City Environs, Manānūr, Borgampād, Nelipāka, Narsampēt, Kāndahār, Kaulās, Utnoor, Aurangābād.

The Red-wattled Lapwing or 'Did-he-do-it' is a common and familiar bird throughout the State being invariably met with in pairs or parties of 3 or 4 in the vicinity of tanks, flooded fields or puddles in open waste-land or in forest clearings.

*Breeding:* On 14 April (Aurangābād) a nest was found among scabs of dry algae on the bed of a small square masonry tank among the ruins near 'Bibi-kā-Maqbera'. It was a shallow depression or 'scrape' without lining, and contained 3 fresh eggs.

Col. Sparrow collected many clutches of 2-4 eggs at Eswantarāopēt, Trimulgherry and Navipēt between 14 April and 15 August. According to Davidson and Wenden (S.F., vii, 88) this Lapwing breeds from March to August in the Bhīma Valley (Deccan).

In the neighbourhood of Bombay (Salsette and Kihim—N. Konkan) I have taken many nests between 29 March and 31 July.

**Lobipluvia malabarica** Boddaert. The Yellow-wattled Lapwing.

*Charadrius malabaricus* Boddaert., Tabl. Pl. Enl., p. 53 for Pl. Enl. 880 (1783)—Malabar.

Specimens collected: 483 ♂, 484 ♀ 18-12-32 Āsifābād 1,200 ft.

Elsewhere noted at: Manānūr, Borgampād, Nelipāka, Pāloncha, Kandahār, Deglūr, Kaulās, Utnoor.

Iris brown; wattles and skin round eye bright lemon-yellow; bill brownish-black; legs and feet bright lemon-yellow; claws brownish-black.

This Lapwing is also a fairly common species, being met with in pairs or small parties of 3 or 4 on fallow and waste-land or ploughed fields, less dependently on the neighbourhood of water than the foregoing.

Baker says (F.B.I., vol. vi, p. 191) that 'in flight, food and voice it is very similar to the Red-wattled Lapwing'. As regards the voice, at any rate, this statement is hardly correct. Its cry has no suggestion in it of the 'Did-he-do-it' so characteristic of the Red-wattled species. It is a somewhat plaintive, bisyllabic *ti-ee,* punctuated by a high-pitched 'tittering' indulged in especially when the birds are agitated, as when their chicks are being handled.

*Breeding:* The gonads of the specimens were in an undeveloped condition. Col. Sparrow took several clutches of 2-4 eggs each at Trimulgherry and Eswantaraōpēt between 16 May and 6 June, and Davidson and Wenden (S.F., vii, 88) found it breeding in the Bhīma Valley from May to July. At Kihim (Kolaba Dist., North Konkan) I have seen newly born (downy) chicks on 24 June.

**Himantopus himantopus himantopus** (L.). The Black-winged Stilt.

*Charadrius himantopus* Linnæus, Syst. Nat., ed. x, vol. i (1758), p. 151—Southern Europe.

Specimen collected: 202 ♀ 30-10-31 Borgampād 160 ft.

Elsewhere noted at: Manānūr (Mrs. Tasker !); Deglūr.

Iris brown; bill black; legs and feet salmon pink; claws black.

The Black-winged Stilt was present singly or in small numbers round the margins of tanks. I found its distribution rather patchy; at Narsampēt with its numerous tanks, none were noted.

The ovaries of the specimen were in an undeveloped condition.

## FAMILY: SCOLOPACIDÆ.

### SUB-FAMILY: TRINGINÆ.

**Tringa ochropus** Linnæus. The Green Sandpiper.

*Tringa ocrophus* (sic) Linnæus, Syst. Nat., ed. x, vol. i (1758), p. 149—Europe, Sweden.

Specimen collected: 615 ♂ 26-3-32 Kaulās 1,300 ft.

Elsewhere noted at: Narsampēt, Kandahār, Deglūr, Ūtnoor, Kannad.

Iris brown; bill greenish horn colour, blackish at tips; legs and feet greyish green; claws black.

Small numbers of the Green Sandpiper were met with, usually singly, in the vicinity of tanks and flooded paddy-fields. Of 20 or more sandpipers seen at Gangannāpēt Tank at Ūtnoor on 1 April, only one belonged to this species, all the rest being *glareola.* The last recorded was on 16 April when most of these birds seemed to have departed.

The testes of the specimen were undeveloped, but it was completing body moult into breeding plumage. The wing- and tail-quills were fresh.

**Tringa stagnatilis** (Bechst.). The Marsh Sandpiper.

*Totanus stagnatilis* Bechstein, Orn. Taschenb., vol. ii (1803), p. 292—Germany.

Specimen collected: 549 ♂ 14-3-32 Deglūr 1,300 ft.

Elsewhere noted at: Manānūr, Narsampēt, Kandahār.

Iris brown; bill horny-brown, yellowish at chin; legs and feet olive-green; claws black.

Present in fair numbers by tanks, marshland and inundated paddy-fields.

The testes of the specimen showed signs of enlargement measuring ca 3×2 mm. The bird was in freshly moulted breeding plumage and was extremely fat indicating that it was ready for emigration to its northern breeding grounds.

**Tringa hypoleucos** Linnæus. The Common Sandpiper.

*Tringa hypoleucos* Linnæus, Syst. Nat., ed. x, vol. i (1758), p. 149—Europe, Sweden.

Specimen collected: 233 ♂ 3-11-31 Borgampād 160 ft.

Elsewhere noted at: Hyderābād City Environs, Manānūr, Narsampēt, Mūkhēr, Deglūr, Hanamkonda, Aurangābād.

Iris dark brown; bill horny-brown, greyer at base of lower mandible; mouth pale French grey; legs and feet greenish-grey; claws dusky.

Commonly met with, singly, by tanks, streams, pools and puddles, flooded borrow-pits and the like. 14 March was the last date on which one was noted by the Survey, though at Alibāg (N. Konkan) I have seen one as late as 24 July while another was observed to frequent a tank throughout the monsoon.

The testes of the specimen were in a quiescent state.

**Tringa glareola** Linnæus. The Wood Sandpiper.

*Tringa glareola* Linnæus, Syst. Nat., ed. x, vol. i (1758), p. 149—Europe, Sweden.

Specimen collected: 535 ♂ 12-3-32, 546 ♂ 14-3-32 Deglūr 1,300 ft.

Elsewhere noted at: Ūtnoor, Nīrmal, Aurangābād, Narsampēt.

Iris brown; bill blackish-brown, olive at base; legs and feet pale sage green or olive-green; claws brown.

This was the most abundant of the sandpipers met with in Hyderābād State, going about in small parties as well as in flocks of 20 to 30 birds or more, in inundated paddy fields (preferably where cut or newly grown), and by the marshy reed-covered edges of tanks. The last seen was on 14 April—a solitary bird.

The testes of the specimens were in non-breeding condition. No. 546 (14 March) was in heavy body moult, the rectrices and remiges being fresh.

**Tringa totanus** (Linnæus). The Redshank.

*Scolopax totanus* Linnæus, Syst. Nat., ed. x, vol. i (1758), p. 145—Europe, Sweden.

Specimens not collected.

Noted at: Borgampād, Deglūr.

Pairs and small parties of Redshanks were observed on sandbanks in the Godāvari River, about its junction with the Kinārsāni. At Deglūr they kept to the edges of tanks.

**Glottis nebularia** Gunnerus. The Greenshank.

*Scolopax nebularia* Gunnerus, Leem, Beskr. Finm. Lapp. (1767), p. 251—Norway.

Specimens not collected.

Noted at: Borgampād, Deglūr.

Observed in small numbers—singly or in pairs or small parties of 3 or 4—on sandbanks in the Godāvari River. At Deglūr only a solitary example was seen at a tank (14-3-32).

## SUB-FAMILY: EROLIINÆ.

**Erolia temminckii** (Leisler). Temminck's Stint.

*Tringa temminckii* Leisler, Nachträge zu Bechst. Naturg. Deutschl. (1812), pp. 63-73—near Hanau on the Main.

Specimen collected: 224 ♀ 2-11-31 Borgampād 160 ft.

Elsewhere noted?

**Erolia minuta** (Leisler). The Little Stint.

*Tringa minuta* Leisler, Nachträge zu Bechst. Naturg. Deutschl. (1812), p. 74—near Hanau on the Main.

Specimen collected: 548 ♀ 14-3-32 Deglūr 1,300 ft.

Elsewhere noted at: Hyderābād City Environs, Malkāpūr (along Nālgonda Road).

Iris brown; bill horny-brown, greenish at base of both mandibles; legs and feet olive-green; claws black.

Stints were seen in fair numbers at Borgampād, where they frequented mudbanks and spits in the Godāvari and Kinārsāni Rivers also marshy, cut paddy-fields by the edge of irrigation tanks. They were usually in flocks of 10-30 or more birds, flying swiftly, turning and twisting on the wing in orderly squad formation, and uttering a soft *wit-wit-wit*. In the other localities also, marshy country about irrigation tanks was their favourite haunt.

The ovaries of the specimens were in an undeveloped condition. In No. 548 (14 March) however, the follicles had a distinctly granulated appearance and the bird was moulting its primaries and coverts in preparation for its northern migratory journey.

### SUB-FAMILY: SCOLOPACINÆ.

**Capella gallinago gallinago** (Linnæus). The Common or Fantail Snipe.

*Scolopax gallinago* Linnæus, Syst. Nat., ed. x, vol. i (1758), p. 147—Europe, Sweden.

Specimen collected: 187 ♂ 29-10-31 Borgampād 160 ft.

Elsewhere noted and/or shot at: Nelipāka, Pākhāl Lake, Malkāpūr (along Nālgonda Road), Deglūr, Ūtnoor.

Iris dark brown; bill dark horny-brown, greyish-green at base of lower mandible and brownish-flesh at basal half of culmen; legs and feet greyish-green; claws black.

The Fantail Snipe visits the State in fair numbers during the cold weather, but in my experience it is not nearly so plentiful as the next species. Of 18 birds shot one morning at Nelipāka (12 November) only one belonged to this species, all the rest being Pintails. The bags in other places also invariably contained a much larger proportion of Pintails than Fantails. The birds frequent marshy grassland by the edge of tanks, and waterlogged cut paddy-fields.

A body moult apparently takes place on arrival in their winter quarters as seen in the case of birds shot and examined early in the season. The wing quills of all such birds were fresh, suggesting that these are moulted prior to starting on the southward migration.

The testes of the specimen, of course, were in an undeveloped condition. The latest record I have for this species is 8 April when 2 birds were flushed among reeds bordering a tank at Ūtnoor. One shot was in perfect fresh plumage and fat.

**Capella stenura** (Bonaparte). The Pintail Snipe.

*Scolopax stenura* Bonaparte, Ann. Stor. Nat. Bologna, vol. iv (1830), p. 335—Sunda Island.

Specimens not collected.

Noted and shot at: Borgampād, Nelipāka, Pākhāl Lake, Malkāpūr (along Nālgonda Road), Ūtnoor.

The Pintail Snipe, in my experience, is a much more abundant winter visitor to the State than the foregoing species. They were both found in the same type of country, and usually together. My remarks regarding moult apply to this species as well. The last to be shot or seen were 2 birds on 9 April (Utnoor) both of which were in perfect fresh plumage and very fat.

## ORDER: STEGANOPODES.

### FAMILY: PHALACROCORACIDÆ.

**Phalacrocorax niger** (Vieillot). The Little Cormorant.

*Hydrocorax niger* Vieillot, Nouv. Dict. d'Hist. Nat., nouv. ed., vol. viii (1817), p. 88—India.

Specimens not collected.

Noted at: Narsampēt, Malkāpūr (along Nālgonda Road), Kandahār, Deglūr, Pākhāl Lake.

Present in small numbers on most tanks. When alighting on the water their tails are the first to break the surface and are employed as brakes to check the momentum.

### SUB-FAMILY: ANHINGINÆ.

**Anhinga melanogaster** Pennant. The Indian Darter or Snake Bird.

*Anhinga melanogaster* Pennant, Ind. Zool. (1769), p. 13—Ceylon and Java.

Specimens not collected.

Noted at: Kāzipēt, Dornakal, Narsampēt, Malkāpūr, Ūtnoor.

Met with singly or in scattered pairs on tanks. In common with the Cormorants, they have the characteristic habit of perching on dry stumps etc. in the water or on bare trees at the edge, and spreading out their wings and tails to dry, on the model of the German eagle. These birds also use their tails as a brake when alighting on the water.

## ORDER: HERODIONES.

### FAMILY: IBIDIDÆ.

**Threskiornis melanocephalus** (Latham). The White Ibis.

*Tantalus melanocephalus* Latham, Index. Orn., vol. ii (1790), p. 709—India.

Specimens not collected.

Three or four birds were noted on a tank at Narsampēt on 1 December.

**Pseudibis papillosa** (Temminck). The Indian White Ibis.

*Ibis papillosa* Temm., Planch. Color. d'Ois. (1824), pl. 304—India and Ceylon.

Specimens not collected.

Noted at: Manānūr, Kāzipet, Nelipāka, Narsampēt.

This is not an uncommon species. Pairs and small parties of 3 to 7 or 8 birds were met with about jheels etc., also on the Godāvari River. Their cries or 'screams' are reminiscent of those of the Ruddy Sheldrake.

It is said to be common in the Bhīma Valley and to breed in May and again in the last three months of the year (Davidson and Wenden, S.F., vii, 92).

## SUB-ORDER: CICONIÆ.

### FAMILY: CICONIIDÆ.

**Ciconia ciconia** (Linnæus). The White Stork.

*Ardea ciconia* Linnæus, Syst. Nat., ed. x, vol. i (1758), p. 142—Europe, Sweden.

No specimens collected.

Noted at: Narsampēt (29-11-31), Devarkōnda (Mahbūbnagar Dist., 11-2-32 Mrs. Tasker !), Deglūr (15-3-32).

I only saw a party of 4 White Storks feeding on the reed-covered marshy edge of a tank near the town (Narsampēt) and a solitary bird in similar facies at Deglūr.

The red bills, which I particularly noted, would indicate that they belonged to the typical race.

**Dissoura episcopus episcopus** (Boddaert). The White-necked Stork.

*Ardea episcopus* Boddaert., Tabl. Pl. Enlum, p. 54 (1783) for Pl. Enlum. 906—Coromandel Coast.

No specimens collected.

Noted at: Borgampād, Pākhāl Lake, Āsifābād, Devarkōnda (Mahbūbnagar Dist. Mrs. Tasker !), Deglūr.

Usually seen in pairs, feeding on water-logged fallow land or the edge of tanks, or sailing in circles high up in the air in parties of 3 to 5 birds. On 7 December one was noted on a lofty tree in the forest near Pākhāl Lake beside a partially-built nest—a huge platform of twigs—at about 30 ft. from the ground. I am, however, not positive that the nest belonged to the bird though presumably this was the case. Davidson and Wenden (S.F., vii, 90) found it breeding in Sholāpūr Dist. in December and January, and in Satāra Dist. in February.

**Xenorhynchus asiaticus asiaticus** (Latham). The Black-necked Stork.

*Mycteria asiatica* Latham, Ind. Orn., vol. ii (1790), p. 670—India.

No specimens collected.

At Borgampād a pair was observed through glasses circling high overhead (3-11-31).

**Leptoptilos dubius** (Gmelin). The Adjutant.

*Ardea dubia* Gmelin, Syst. Nat., vol. i, pt. ii (1789), p. 624—India.

Not met with by the Survey.

Davidson and Wenden (S.F., vii, 90) and Fairbank (S.F., iv) observed the Adjutant in the Deccan, but record it as rare. Davidson saw one feeding with a lot of vultures.

**Leptoptilos javanicus** (Horsf.). The Smaller Adjutant.

*Ciconia javanica* Horsfield, Trans. Linn. Soc., vol. xiii, pt. i (May 1821), p. 188—Java.

Not met with by the Survey.

Davidson and Wenden (S.F., vii, 90) write as follows: 'Wenden is sure that he has seen this bird on more than one occasion about the marshy tanks on the outskirts of the Nulwar jungles. It is, however, a very rare visitant, and seen in the rainy season only'.

**Ibis leucocephalus leucocephalus** (Pennant). The Painted Stork.

*Tantalus leucocephalus* Pennant, Ind. Zool. (1769), p. 11, pl. 10—Ceylon.

No specimens collected.

A flock of 5 birds was observed on a mudbank in the Godāvari River at Borgampād on 1-11-31.

**Anastomus oscitans** (Boddaert). The Open-billed Stork.

*Ardea oscitans* Boddaert, Tabl. Pl. Enlum. (1783), p. 55 for Pl. Enlum. 932—Pondicherry.

No specimens collected.

Small flocks were observed on jheels at Kāzipet (27-10-31) and Mūlūg (Warangal Dist., May 1927).

## SUB-ORDER: ARDEÆ.

### FAMILY: ARDEIDÆ.

**Ardea purpurea manillensis** Meyer. The Purple Heron.

*Ardea purpurea* var. *manillensis* Meyer, Nova Acta Acad. Leop. Carol., vol. xvi, Suppl. (1834), p. 102—Philippines.

Specimen collected: 644 ♀ 4-4-32 Ūtnoor 1,250 ft.

Elsewhere noted at: Borgampād, Nelipāka, Narsampēt.

Iris bright yellow; bare lores and lower mandible greenish-yellow, upper mandible mostly horny-brown; bare tibia yellow; tarsus horny-brown; hind aspect of tarsus and soles of feet yellow.

Usually met with as a solitary bird standing motionless in water by river banks and islets or reedy tanks, darting forward with its bill now and again as some frog or fish comes within striking distance.

The ovaries of the specimen were in a quiescent state. It was undergoing a complete moult.

**Ardea cinerea** Linnæus. The Common Grey Heron.

*Ardea cinerea* Linnæus, Syst. Nat., ed. x, vol. i (1758), p. 143—Europe, Sweden.

No specimens collected.

Noted at: Borgampād, along Nekōnda-Narsampēt Road and at Ūtnoor, singly as the foregoing.

Major-General E. F. Burton in his 'Reminiscences of Sport in India' (published about 1885) mentions a heronry close to a small village which he passed en route from Hanamkonda to 'Percall' Lake (Parkāl or Pākhāl?) in February 1847 where 'the great blue birds occupied all the topmost branches of the tall trees with their coarsely formed nests and straddled over their eggs and young in an ungainly way'. February (unless there is some oversight here) is much too early a month for these birds to have had young. The breeding season is usually in the monsoon months.

**Egretta alba** (Linnæus). The (Eastern) Large Egret.

*Ardea alba* Linnæus, Syst. Nat., ed. x, vol. i (1758), p. 144—Europe.

No specimens collected.

Noted at: Kāzipet, Borgampād, Narsampēt, Devarkōnda (Mahbūbnagar Dist., Mrs. Tasker !), Deglūr.

Usually seen as a solitary bird on sandbanks in the Godāvari and Kinārsāni Rivers, also by marshy reed-bordered tanks. On one occasion 8 or 10 were seen together on a sandbank, presenting a magnificent sight.

*Breeding*: Col. Sparrow has two eggs from Navipēt, 10-8-14.

**Egretta garzetta** (Linnæus). The Little Egret.

*Ardea garzetta* Linnæus, Syst. Nat., ed. xii, vol. i (1766), p. 237—'In Oriente'.

No specimens collected.

Noted along road between Achampēt and Hyderābād City, and at Kandahār. The birds were fairly common in the vicinity of water.

I seem to have overlooked *intermedia*, which I find not recorded in my field notes, but which must surely occur in this area.

**Bubulcus ibis** (Linnæus). The Cattle Egret.

*Ardea ibis* Linnæus, Syst. Nat., ed. x, vol. i (1758), p. 144—Egypt.

No specimens collected.

Noted at: Hyderābād City Environs, along Nekōnda-Narsampēt Road, Kandahār, Deglūr, Ūtnoor.

The Cattle Egret is a common species in Hyderābād, usually seen in attendance on grazing cattle, picking up grasshoppers and other insects disturbed by the animals' progress through the grass.

In a ploughed inundated field near Narsampēt I noticed an assemblage of many hundreds of these birds, apparently for the benefit of the frogs!

**Ardeola grayii** (Sykes). The Indian Pond Heron or Paddy Bird.

*Ardea grayii* Sykes, P.Z.S. 1832 (22 November), p. 158—Dukhun.

No specimens collected.

Noted at: Manānūr, Borgampād, Narsampēt, Kandahār, Deglūr, Kaulās, Ūtnoor, Hyderābād City and Environs.

A common and familiar species frequenting tanks, ponds and even kutcha wells, and feeding principally on frogs.

On 9 October (Manānūr) some individuals were still in breeding plumage.

*Breeding*: At Navipēt on 10-8-14, Col. Sparrow found several nests with 3 or 4 eggs each in varying stages of incubation, and also large young.

**Butorides striatus javanicus** (Horsfield). The Indian Little Green Heron.

*Ardea javanica* Horsfield, Trans. Linn. Soc., vol. xiii, pt. i (May 1821), p. 190—Java.

Specimens collected: 542 ♂ 13-3-32 Deglūr 1,300 ft.; 661 ♂ 6-4-32 Ūtnoor 1,250 ft.

Elsewhere not noted.

Iris bright lemon yellow; upper mandible dark horny-brown, lower sage green; eyelids and bare patch in front of eyes bright yellowish leaf-green; legs and feet yellowish leaf-green, yellower on hind tarsus and soles; claws dusky.

On both occasions solitary birds were flushed from secluded, well-shaded rocky pools in stream beds. At Ūtnoor the stream ran through deciduous forest. Their stomachs contained mostly remains of crabs and frogs.

The testes of the specimens were undeveloped. No. 661 (6 April) was undergoing a body moult, the rectrices and wing-quills being unaffected.

**Nycticorax nycticorax** (Linnæus). The Night Heron.

*Ardea nycticorax* Linnæus, Syst. Nat., ed. x, vol. i (1758), p. 142—Southern Europe.

No specimens collected.

Noted at: Pāloncha, Hyderābād City, Kandahār, Deglūr, Ūtnoor.

Usually seen flighting to and from their feeding grounds by tanks etc., at dusk and early in the mornings. Though often from the same roost, the birds do not fly in any kind of orderly flocks. They utter loud hoarse *quaak's* from time to time as they flap lazily along.

## ORDER: ANSERES.

### SUB-FAMILY: PLECTROPTERINÆ.

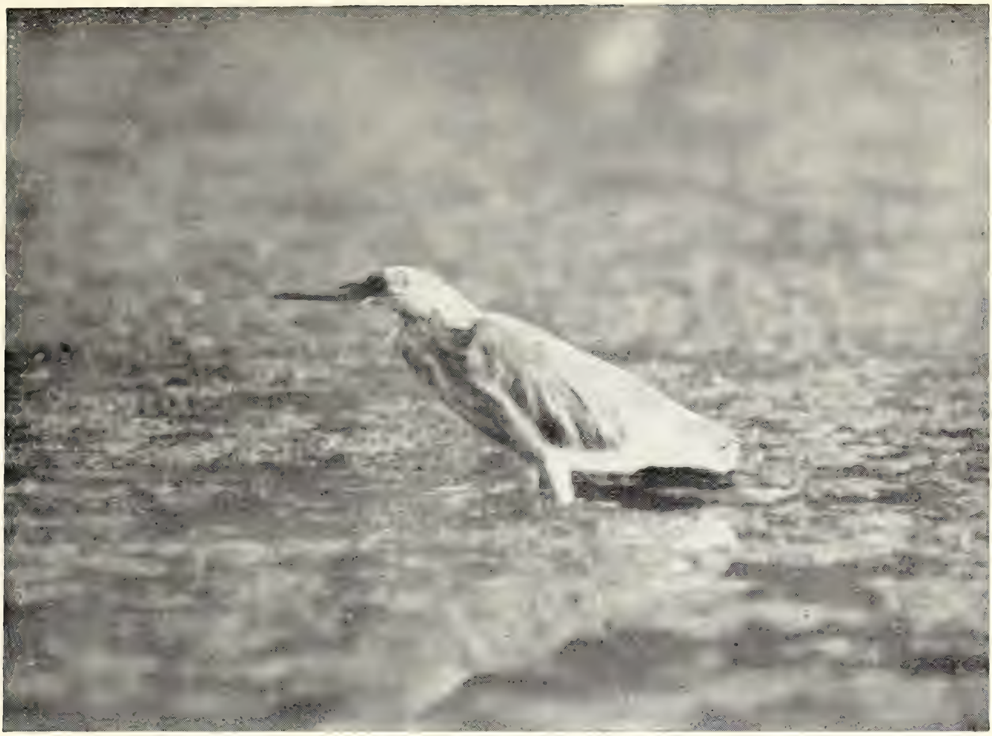
**Sarkidiornis melanota** (Pennant). The Nukhta or Comb Duck.

*Anser melanotos* Pennant, Ind. Zool. (1769), p. 12—Ceylon.

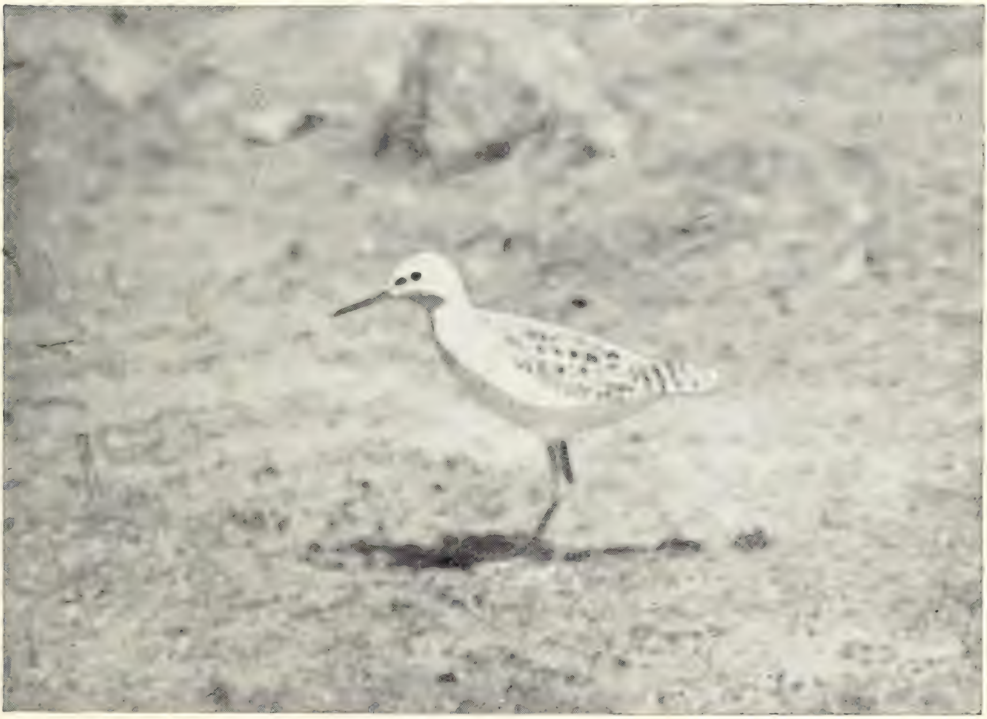
No specimens collected.

Noted and/or shot at: Manānūr, Pāloncha, Narsampēt, Ūtnoor.

The Nukhta was present in small numbers on jheels and tanks. At Ūtnoor only a solitary bird was seen (5 April). On 11 October (Manānūr) a duck was observed on a tank accompanied by 14 half-grown ducklings. She refused to



1. Paddy-bird (*Ardeola grayii*) wading after Frogs.



2. Green Sandpiper (*Tringa ochropus*) in breeding plumage preparatory to emigration. Late April.

*Photos by Author.*

forsake the brood even when her mate (?) and another duck of the party flew away to the report of shots close by. As late as 25 November (Pāloncha) also, another bird was noted to be accompanied by 3 half-grown ducklings.

### SUB-FAMILY: CHENONETTINÆ.

**Nettapus coromandelianus** (Gmelin). The Cotton Teal.

*Anas coromandeliana* Gmelin, Syst. Nat., vol. i, pt. ii (1789), p. 522—Coromandel, India.

Specimens collected: 405 ?, 406 ? (imm.) 2-12-31 Narsampēt 800 ft.

Elsewhere noted at: Hyderābād City Environs, Malkāpūr (Nālgonda Road), Ūtnoor.

Iris dark brown; bill, upper mandible plumbeous-brown, lower pale dull orange-flesh colour; legs and feet greyish-green; claws brown.

This little teal is a fairly common resident in the State and is present in some numbers on most tanks and jheels. The largest flock seen was of about 50.

No. 406 (2 December) was a young bird with soft skull, just growing its wing-quills.

### SUB-FAMILY: ANATINÆ.

**Dendrocygna javanica** (Horsfield). The Lesser or Common Whistling Teal.

*Anas javanica* Horsfield, Trans. Linn. Soc., vol. xiii, pt. i (1821), p. 199—Java.

Specimens collected: 407 ? 2-12-31 Narsampēt 800 ft.

Elsewhere noted at: Manānūr, Borgampād, Deglūr, Ūtnoor, Hyderābād City Environs, Malkāpūr (along Nālgonda Road).

Iris dark brown; eyelids dull chrome yellow; bill slaty-black; legs and feet slate colour.

The Lesser Whistling Teal is one of the two commonest resident ducks in the State, the other being the Cotton Teal. It usually keeps in flocks of from 8 to 30 birds or more, of which one or two will be found on every jheel of any size.

On a tank at Narsampēt, a pair were seen accompanied by 3 half-grown ducklings on 2 December.

**Dendrocygna fulva** (Gmelin). The Large Whistling Teal.

*Anas fulva* Gmelin, Syst. Nat., vol. i (1839), p. 530—Novo Hispania.

Not met with by the Survey.

Davidson and Wenden (S.F., vii, 92) write: 'W. is sure he has observed this species at Nulwar and shot several in 1873'. Fairbanks (S.F., iv) also obtained a pair once near Ahmadnagar, but this was the only occasion on which he came across the species.

**Casarca ferruginea** (Pallas). The Ruddy Sheldrake or Brahminy Duck.

*Anas ferruginea* Pallas in Vroeg, Cat. d'Ois. Adumb. (1764), p. 5—Tartary.

No specimens collected.

Noted only at Nelipāka where small parties were frequently seen flying up and down the Godāvari River and resting on the sandbanks.

**Anas pœcilorhyncha** J. R. Forster. The Spot-bill or Grey Duck.

*Anas pœcilorhyncha* J. R. Forster, Zoöl. Indica (1781), p. 23, pl. 13, fig. i—Ceylon.

No specimens collected.

Noted and/or shot at: Manānūr, Malkāpūr (along Nālgonda Road), Deglūr.

Found on tanks and jheels in small numbers.

**Nettion crecca** (Linnæus). The Common Teal.

*Anas crecca* Linnæus, Syst. Nat., ed. x, vol. i (1758), p. 125—Europe, Sweden.

No specimens collected.

Noted and/or shot at: Aurangābād, Pālonchā.

Present on tanks etc. in small numbers, along with other species. Also observed in flooded borrow-pits by road.

**Querquedula querquedula** (Linnæus). The Garganey or Blue-winged Teal.

*Anas querquedula* Linnæus, Syst. Nat., ed. x, vol. i (1758), p. 126—Europe, Sweden.

No specimens collected.

Noted and/or shot at: Deglūr, Malkāpūr (along Nālgonda Road), Ūtnoor.

Seen in flocks of 50 or more on tanks and jheels. It is an inveterate diver and swims well under water. This species is one of the earliest of the migratory wildfowl to arrive in India and also the latest to leave. A flock of 8 was seen at Ūtnoor on 9 April when no other migratory ducks were present.

**Spatula clypeata** (Linnæus). The Shoveller.

*Anas clypeata* Linnæus, Syst. Nat., ed. x, vol. i (1758), p. 124—Europe, S. Sweden.

No specimens collected.

Noted and/or shot at: Borgampād, Deglūr, Utnoor (15-10-24), Malkāpūr.

The Shoveller is fairly common on tanks and jheels, but not numerous. It keeps in small flocks of 6-8 birds.

### SUB-FAMILY: NYROCINÆ.

**Nyroca ferina** (Linnæus). The Pochard or Dun Bird.

*Anas ferina* Linnæus, Syst. Nat., ed. x, vol. i (1758)—Europe, Sweden.

No specimens collected.

Noted and/or shot at: Hyderābād City Environs, Malkāpūr, Kandahār, Deglūr.

A fairly common species on tanks and jheels.

**Nyroca fuligula** (Linnæus). The Tufted Pochard.

*Anas fuligula* Linnæus, Syst. Nat., ed. x, vol. i (1758), p. 128—Europe, Sweden.

No specimens collected.

Noted and/or shot at: Malkāpūr, Devarkōnda (Mrs. Tasker !), Kandahār, Deglūr.

A common species in winter on irrigation and village tanke and jheels, often in large numbers.

I have no doubt that a good many species of duck besides those mentioned above must occur within our limits during the cold weather months. Duck-shooting on the whole, however, is rather poor in the Hyderābād State as the tanks on which the birds are mostly found are artificial reservoirs for irrigation purposes where the water is usually too deep or too open to supply the requirements of the sport. It is interesting to read in Major-General E. F. Burton's 'Reminiscences of Sport in India' the description of a journey from Hanamkonda (then a military station occupied by the Hyderābād Contingent) to 'Percall' Lake, thirty miles 'through wild country studded with fine sheets of water which were full of ducks and geese of all kinds'. The geese most probably were of the Bar-headed species (*Anser indicus*) which doubtless even now visit parts of the State in the cold weather. The nearest place to the Hyderābād State where I have come across them is on the Godāvari River near Nāsik.

## ORDER: PYGOPODES.

### FAMILY: PODICEPIDÆ.

**Podiceps ruficollis** (Pallas). The Indian Little Grebe or Dabchick.

*Podiceps ruficollis* Pallas in Vroeg. Cat. d'Ois. Adumb. (1764)—Holland.

No specimens collected.

Noted at: Hyderābād City Environs, Manānūr, Kāzipēt, and along the railway line to Dornakal, Narsampēt, Malkāpūr, Kandahār, Deglūr, Ūtnoor, Nīrmal.

A common species throughout the State, almost invariably present on tanks and jheels. A pair was also noted in the moat surrounding Kandahār Fort.

*Breeding*: Col. Sparrow has taken several clutches of the Dabchick's eggs (usually 6) at Mulkaram, Eswantarāopēt and elsewhere, between 26 July and 9 September.

(*The end*).

# EARTH-EATING AND SALT-LICKING IN INDIA.

BY

J. F. Caius, s.j., f.l.s.

AND

S. K. Chhapgar, b.sc.

(*St. Xavier's College, Bombay*).

(*Continued from page* 981 *of volume* xxxvi).

## ANALYSES XXXII-XXXV.

### XXXII.—Common Earth.

Serial No. 28.

Locality.—Near Murtiha in the Reserved Forest of Bahraich District, United Provinces.

Collected and sent by—The Divisional Forest Officer, Bahraich.

Cement-grey, friable lumps with rootlets. Powder soft.

| | | |
|---|---|---|
| Minerals ... ... ... | 0·79 | per cent. |
| Clay ... ... ... | 9·19 | ,, |
| Sand ... ... ... | 84·59 | ,, |
| Organic debris ... ... ... | 2·13 | ,, |
| Humus ... ... ... | 0·35 | ,, |
| Moisture ... ... ... | 2·96 | ,, |
| *Fine Earth* (20 mesh sieve) ... ... | 96·103 | ,, |
| Insoluble in nitric acid ... ... | 77·611 | ,, |
| Soda ($Na_2O$) ... ... ... | 1·681 | ,, |
| Potash ($K_2O$) ... ... ... | 0·588 | ,, |
| Magnesia ($MgO$) ... ... ... | 0·431 | ,, |
| Lime ($CaO$) ... ... ... | 0·449 | ,, |
| Alumina ($Al_2O_3$) ... ... ... | 1·946 | ,, |
| Silica ($SiO_2$) soluble ... ... ... | 6·630 | ,, |
| Sulphur ($SO_3$) ... ... ... | 0·003 | ,, |
| Phosphorus ($P_2O_5$) ... ... ... | 0·147 | ,, |
| Ferric oxide ($Fe_2O_3$) ... ... | 3·146 | ,, |
| Moisture and organic matter ... | 5·155 | ,, |

*Remarks.*—1. The earth was taken within 100 yards from, but outside, Salt-Lick No. 27.

2. 'The earth from the salt-lick is very hard and unmistakeable, and that from the adjoining area is easier to break and crumble.' (D. Davis, Esq., i.f.s.).

## XXXIII.—Common Earth.

Serial No. 46.

Locality—Gonda Forest Division, Bhambar Range, Chandanpore Block.

Collected and sent by—The Forest Ranger, Bhambar Range, United Provinces.

Hard buffy lumps crumbling to powder. Powder soft.

| | | |
|---|---|---|
| Clay | 5·41 | per cent. |
| Sand | 91·19 | ,, |
| Organic debris | 2·07 | ,, |
| Moisture | 0·19 | ,, |
| *Fine Earth* (20 mesh sieve) | 99·37 | ,, |
| Insoluble in nitric acid | 81·454 | ,, |
| Potash ($K_2O$) | 3·196 | ,, |
| Magnesia (MgO) | 0·269 | ,, |
| Lime (CaO) | 0·312 | ,, |
| Alumina ($Al_2O_3$) | 2·052 | ,, |
| Silica ($SiO_2$) soluble | 7·310 | ,, |
| Ferric oxide ($Fe_2O_3$) | 2·002 | ,, |
| Moisture and organic matter | 2·940 | ,, |

*Remarks.*—1. The soil contains traces of humus and phosphorus.

2. The earth was collected at a distance of about a chain from Salt-Lick No. 47, on the left in cpt. 101 B.

## XXXIV.—Soil from Salt-Lick.

Serial No. 47.

Locality—Gonda Forest Division, Bhambar Range, Chandanpore Block, United Provinces.

Collected and sent by—The Forest Ranger, Bhambar Range, United Provinces.

Hard buffy lumps crumbling to powder. Powder soft.

| | | |
|---|---|---|
| Minerals | 0·06 | per cent. |
| Clay | 10·34 | ,, |
| Sand | 86·58 | ,, |
| Organic debris | 1·76 | ,, |
| Humus | 0·08 | ,, |
| Moisture | 1·09 | ,, |
| *Fine Earth* (20 mesh sieve) | 99·532 | ,, |
| Insoluble in nitric acid | 83·519 | ,, |
| Potash ($K_2O$) | 1·213 | ,, |
| Magnesia (MgO) | 0·283 | ,, |
| Lime (CaO) | 0·230 | ,, |
| Alumina ($Al_2O_3$) | 3·432 | ,, |
| Silica ($SiO_2$) soluble | 6·725 | ,, |

| | | |
|---|---|---|
| Phosphorus ($P_2O_5$) ... ... ... | 0·916 | per cent. |
| Ferric oxide ($Fe_2O_3$) ... ... ... | 1·552 | ,, |
| Moisture and organic matter ... ... | 2·110 | ,, |

*Remarks*.—1. The soil contains traces of manganese.

2. (*a*) The earth was collected on the right of Chandanpore-Nerhewa 15 ft. road in cpt. 103A, about 500 yds. from Chandanpore Forest Rest-house.

(*b*) Cows, deer, chital, sambhar, barking deer, four-horned deer, and sometimes pigs, porcupine, and langoor black-faced monkeys visit these licks. In some places cattle are very fond of it; so much so that if they are not driven away by their owner, the animals will overfeed and kill themselves.

(*c*) All the wild animals visit the Kila at night, but sambhar are always late comers. They lick salt all the year round, but mostly in wet weather when the earth is soft. October is the best period for the wild animals.

(*d*) 'The reason why they take to this is that it acts on them as a purgative and feel refreshed after they have taken it.' (Ganga Ram. F.R.O.).

### XXXV.—SOIL FROM SALT-LICK.

SERIAL NO. 48.

LOCALITY—Sironcha Range, Chanda District, Central Provinces.

COLLECTED AND SENT BY—The Deputy Conservator of Forests, South Chanda Division.

Friable grey lumps with a few rootlets. Powder gritty and soapy to the touch.

| | | |
|---|---|---|
| Minerals ... ... ... | 2·84 | per cent. |
| Clay ... ... ... | 5·47 | ,, |
| Sand ... ... ... | 82·55 | ,, |
| Organic debris ... ... ... | 4·83 | ,, |
| Moisture ... ... ... | 3·86 | ,, |

| | | |
|---|---|---|
| *Fine Earth* (20 mesh sieve) ... ... | 93·408 | ,, |
| Insoluble in nitric acid ... ... | 64·646 | ,, |
| Soda ($Na_2O$) ... ... ... | 0·891 | ,, |
| Potash ($K_2O$) ... ... ... | 0·960 | ,, |
| Magnesia (MgO) ... ... ... | 0·452 | ,, |
| Lime (CaO) ... ... ... | 0·580 | ,, |
| Alumina ($Al_2O_3$) ... ... ... | 4·872 | ,, |
| Silica ($SiO_2$) soluble ... ... ... | 12·180 | ,, |
| Sulphur ($SO_3$) ... ... ... | 0·117 | ,, |
| Phosphorus ($P_2O_5$) ... ... ... | 1·497 | ,, |

| | | |
|---|---|---|
| Ferric oxide ($Fe_2O_3$) .... .... .... | 1·321 | per cent. |
| Moisture and organic matter ... .... | 4·850 | ,, |

*Remarks.*—The following animals visit the salt-licks specially in rains when the ground is soft:—

> Elephants, buffaloes, bisons, barasinga, blue bulls, sambars, chitals, other kinds of deer, pigs, monkeys, all domestic cattle. They lick this earth and drink water as well collected in salt-lick areas to have a change of taste after their daily feed. They eat this earth in excess when they want to clean their bowels or when they get eruption on their tongue. (Range Officer, Sironcha Range).

## ADDITIONS AND CORRECTIONS.

*Journ. Bomb. Nat. Hist. Soc.*, vol. xxxvi, No. 1, November 15, 1932, p. 219.

XVI.—SERIAL NO. 81. *Remarks.*—2. The lick lies between Wain and Balahama about eight miles out of Srinagar, Kashmir, at a distance of about two miles from Khanmoo Rukh Big Game Reserve, which is a part of the lower ranges of Kashmir mountains. The lick is a mound on small rising ground in the field at the foot of the above range.

3. It is in the winter months only that the stags in numbers come out of the Khanmoo Rukh and lick the earth all round this hillock and everywhere on it. They have a great liking for it.

XVII.—*Soil from Salt-Lick* to read *Common Earth.*

XVII.—SERIAL NO. 82. *Remarks.*—2. The earth was collected from an area adjoining Salt-Lick No. 81.

P. 224—XXV. SERIAL NO. 156. *Remarks.*—2. The place was a little cliff about 6 ft. high, its foot sloping down to a shallow ford in a small stream. Both the ford and the foot of the cliff showed every sign of being much frequented by sambar, cheetal, and barking deer; but there were no sign of bison or tiger or panther foot-prints. The jungle-man with me pointed out porcupine foot-prints actually at the salt-lick . . . There has been a good deal of rain in these parts in the last week, and the soil between the cliff and the stream was all puddled and soft, and so was much of that at the actual foot of the cliff.

3. The sample was collected from the central boss of plastic clay encircled by a smooth channel, about 12 in. or 15 in. in radius; the channel possibly made by deer's chins or tongues, I can't be sure which, it being about 3½ in. across and 2½ in. deep. The central boss bore distinct tongue marks as having been licked, and also queer flat impressions, mixed up with the lick marks, and with a distinct sort of golf ball 'bramble' marking pattern on them. Whether these can have been caused by the tongue being laid on the earth and lifted with a sucking effect I do not know . . . The porcupine foot-prints were seen on this central boss . . . Deer had knelt to get their heads down to this spot . . . Other parts of the cliff at the same point showed less regular marks of being licked and bitten,

Vol. xxxvi, No. 4, December 15, 1933, p. 978.

XXVI.—Serial No. 157. *Remarks.*—3. A few feet further along there was a part of the cliff about 4 ft. from the ground level where the earth was hard and dry and which showed fresh marks of being bitten. I collected a sample of this also (No. 157). The foot of the cliff at this point also was puddled and plastic and had a straight channel very much like the circular channel referred to above (cf. No. 156). Apparently showing that at the time some of the deer were at it last night. The earth was very much more liquid; one could see drops of solidified mud lodged on a bank some 3 ft. high just above the end of this channel. These drops must have dropped off their chin.

XXVII.—Serial No. 13. *Remarks.*—2. The sample is from the South Banda Range of the Banda Forest Division. These forests are on the Vindhya Range and Panna Plateau.

# REVIEWS.

## I. EVOLUTION OF HABIT IN BIRDS. By Edmund Selous, 296 pages, London, 1933 (Constable & Co. Ltd.).

For many years now, the name of Edmund Selous has been well to the fore amongst ornithologists and nature-lovers. His excellent field studies of living birds presented to us through the pages of various natural history magazines and journals, have earned him just renown and have, moreover, been largely responsible for the happy change that has come about in recent years in the attitude of the 'scientific' or 'museum' ornithologist towards the value and importance of this type of research. Field observation had come to be regarded in 'museum scientist' circles with something akin to contempt or at the most with a species of benign indulgence as being merely 'bird-lore' and of little or no scientific value.

Fortunately for science, things have taken a healthier turn and it is now becoming increasingly recognised that the contribution which intelligent and rational field observation can make in unravelling many of Nature's puzzles is as great, if indeed not greater than any the pure museum worker (Systematist or Classification-monger, as the author feelingly calls him !) with often merely a pile of dry stuffed skins at his disposal, can. In other words it is becoming increasingly clear that to understand the ecology, i.e. the relation of an organism to its surroundings, its affinities with other creatures and its position in the general scheme of Nature, field observation is the only dependable *via media*. While systematic work and classification are also indispensable to a proper understanding of such problems, they are likewise only a means to the end and not the end itself.

In the present volume the author has attempted to show how his own observations on many different species of living birds have brought him to the conclusion that all or most of the habits noticeable in this group at the present day are the outcome of something more fundamental than appears on the surface, and that many of them can be directly attributed to the subtle influences of sex, i.e. that many of the habits which we see crystalized among our modern birds have a sexual origin, and being of direct benefit to the species, have been worked upon and evolved by Natural Selection, a factor to which the author attaches cardinal importance. Such acts among Stock Doves and Stone-Curlews as the assuming of bellicose and ludicrous postures without engaging in actual serious combats are, he believes, where fighting has passed into formality to the benefit of the species, since actual encounters in strong and well-armed birds would result in heavy mortality to the detriment of the race. These mock battles, martial displays and sabre-rattling which the author terms 'Formalisation', have according to him clearly grown out of real fights, thus resulting in 'the proportionate dissipation through Natural Selection of energies that have become to any extent deleterious, into channels entirely or comparatively innocuous.' He suggests that 'Formalisation' is only practised *inter se* i.e. between rival individuals of the same species, but that against an outside enemy like a dog it is still capable of turning into actual and serious fighting.

In another part of the book entitled 'Sexual Origin of Nest-building' the author attempts to demonstrate by a copious citation of his notes relating to the Peewit, Blackbird, Flycatcher and other species, that nidification has been slowly developed out of physiological reaction to sexual stimulus. He affirms—and we think with reason—that the origin of nest-building can never have been purely architectural. It is pointed out that in the case of the Lapwing's nest, the scrape in which the eggs are laid has originated not as a deliberate and thought-out plan, but merely accidentally from the bird's observable habit of pressing its breast down and turning round and round excitedly, when its actions are exactly the same as in the act of copulation. The movements are indulged in principally by the male in the breeding season, probably as an outlet to his exuberant and surplus energy. Bits of grass etc. are torn up at the same time from the immediate surroundings and allowed to drop at the sides and find their way into the scrape, suggesting or explaining the origin of the lining.

Many other topics of absorbing interest are discussed in other chapters, such as Origin of Sexual Display in Birds, Suggested Origin of Darwinian Selection, Origin of Domestic Cleanliness, Parental Care of Young, and Song in Birds, based on the author's field observations.

We have nothing but admiration for the painstaking manner in which the author has recorded his field observations and collected his data, and for the ingenuity with which he has interpreted it. In a footnote somewhere, he says 'My idea is that in serious field natural history, by which I mean the kind into which thinking as well as seeing enters, every reader is entitled to the actual field notes of the author where these exist and are pertinent. True, he may not want them, but in that case the serious element is absent on *his side.*' Acting upon this principle the author has filled his book with copious notes in which many observations often also those not immediately bearing on the subject in hand, are brought in. While we agree that every reader is entitled to the field notes of an observer, we think some better and more convenient method should have been devised—such as in an appendix—for presenting them rather than in the actual text. The procedure now adopted tends to make the style unnecessarily involved, and it is often quite difficult for the reader not to lose the thread of the author's arguments and reasoning, or to arrive at the conclusions he is expected to.

The book is nevertheless a stimulating, and in many respects an original one. It provides plenty of food for thought to scientist and layman alike, and deserves to be read by all naturalists and bird-lovers.

S. A. A.

II. NATURE STUDY READERS. The Teachers' Scheme Book for First and Second Year Pupils. By Phyllis S. Darling, M.R.S.T., F.R.G.S. (Oxford University Press). Price As. 8.

One of the greatest obstacles in the teaching of Nature Study in Indian schools has been, and still is, the lack of teachers who are themselves familiar with the subject. The ordinary teacher in primary, secondary and even high schools, is usually as much a stranger to Nature Study as are his pupils, and it is therefore not surprising that he should often resent this further addition to the already long list of subjects he is expected to teach. Even among better qualified teachers, including those possessing an academic degree in Natural Sciences, there are very few endowed with the gift of bringing their knowledge down to a level where it will be readily intelligible to the children. Neither is it sufficient for the teacher merely to make himself understood, for unless he can at the same time succeed in arousing the necessary interest in the child and creating in his pupil a thirst for further knowledge and investigation, the essence of Nature Study teaching is lost.

With a view to easing the lot of the average school teacher, primarily, a series of Nature Study Readers is being written by Mrs. Darling, the first of which had already been published while others are in course of preparation. The aim of the present booklet is to help teachers in inculcating in their pupils a love of Nature and a spirit of independent enquiry and research which will goad them on to observing and investigating things for themselves and finding out the answers to their difficulties without recourse to continual assistance and 'spoon-feeding'. This admittedly is the true aim and purpose of Nature Study teaching.

The readers will supply a real and long-felt want and we hope they will receive the encouragement they deserve from educational institutions in this country. We also hope that in course of time they may be translated into the vernaculars so as to be available to teachers in village schools who are often ignorant of English.

S. A. A.

III. INDO-CHINA, A SPORTSMAN'S OPPORTUNITY. By Archibald Harrison, made and privately printed at the Mayflower Press, Plymouth, 1933, 157 pages with 12 photographs and a sketch map of itinerary of the trip.

Archibald Cary Harrison, an American sportsman, died in London in 1928 and this record of his experience in Indo-China during a hunting expedition undertaken in 1917 is now privately printed by his daughter and his elder brother.

It is evident from the Foreword, dated May 1918, and other indications in the book, that Archibald Harrison intended at one time to publish this record of his observations and experiences in a French colony, but we do not know why the manuscript was laid by for the ten years before his death.

The book is interesting as introducing the reader to a little known country of which the big game possibilities *were* very attractive; but are they so now? The Game Laws for the Province of Lang-Biang provided that in the Reserved Zone in which the Harrison expedition hunted, the Special License (200 piastres), good for three months in the year only allowed one elephant, one gaur, three wild cattle, *and only males*, to be shot; all other beasts except tigers and panthers being protected. In the Protected Zone the law was strict for all forms of game and there was a summer closed season; in the Free Zone a male gaur could be killed for 30 piastres.

The author remarks that these regulations, framed by Mr. Millet and introduced in February 1917, 'will be bound to conserve the game and become important when Annam gets into the sportsman's eye'. From a perusal of the book the obvious remark has to be made that no game laws can be effective if the Forest Officer responsible for their enforcement permits flagrant disregard of them in his presence and actively connives at the slaughter of cows and hinds!

At the time of Archibald Harrison's expedition—13th June to 8th August, 1917—the striking feature of this region to sportsmen was that it was quite unspoiled. Previous visits had been by one famous Frenchman who 'slew widely'; and several Belgians and Germans before the War; besides these had been only the trips of his brother F. B. Harrison, and one or two Americans from the Philippines.

Indo-China consists, as A. H. tells us, of Cochin China, a colony, Tonkin, Laos, Cambodia, and Annam which are protectorates in charge of native Emperors who 'rule' under strictly French supervision. The shooting was done in the sub-division of Liang-Biang in Southern Annam, a narrow strip touching for its entire length the China Sea.

The terrain is mountainous and the climate perfect, the wanderings of the party taking them from five to six thousand feet above the sea. Although it was supposed to be the rainy season most of the days and nights resembled those of September and October in the State of Maine. Occasionally heavy thunderstorms disturbed the afternoons. The relief of getting to the shooting country was a transportation from heat and paddy fields to pine trees and blankets. The forests are described as being in general fairly open, of pine and other large trees, with frequent glades and meadows, the undergrowth knee high, coarse grass growing from soil soft enough to make the tracking of heavy animals possible. The inhabitants are Mois, a simple and friendly tribe of aborigines, gentle savages without any terror or suspicion of the visitor from outside, and both men and women carry a surprising pack willingly, and all day. They were scrupulously honest.

So we realize what a wonderful country is there, on the shores of the China Sea but a thousand miles from Hong Kong, and it is a thousand pities that such sportsmen as E. C. Kirkendall should have ravaged it, and that Archibald Harrison should have had him as a shooting companion. For A. H. was, we realize during perusal of his book, a true sportsman refraining from useless slaughter and at heart, as his brother says of him, a true conservationist of game.

A list of the principal game animals and birds, the former including the python, cobra, and monkeys of eight varieties, closely corresponds to the fauna of Burma. The list is French and says that there are of gaur 3 varieties, of wild cattle 2, of panthers 2, of bear 3, of wild dog 2, and of wild hog 2. Nothing is said in the book about these varieties so we are left to conjecture what they may be. As to the bear and panther one can make a probably accurate guess; but of the others? It would be interesting to have more information.

Mr. Millet of the French Forestry Service was the guide, philosopher, and friend of the party. 'I never had a better shooting companion nor a more expert one'; but it has to be remarked that, although the Game Laws were drawn up by him, conservation of game was not one of his strong points, nor was he a naturalist.

The four tigers shot were obtained by a method originated by Mr. Millet 'the only sure way of killing them'. A. H. remarks that he never heard of the use of a stationary bait in India. Certainly it is not the custom in India to lead an unsuspecting kill to the foot of a stout tree and shoot it behind the ear with a revolver; but both in India and Burma baits are, when beating is not intended, so tied that they cannot be dragged away: and it is a usual practice in parts of Burma to leave out the carcase of any large animal which may have been shot and visit it in the hope that a tiger may have been attracted to the feast. Some of us have essayed Mr. Millet's method of an approach path swept clear of leaves to give noiseless access to a loopholed screen of branches, but not in the systematic fashion here described.

An instance of a tigress covering up a kill with grass is cited; a not unusual occurrence, as recently remarked in connection with Mr. Peacock's book on Burma. It is said on Mr. Millet's authority that panthers turn away from carrion, but that is not at all correct. Night shooting of tiger did not appeal to A. H.; he preferred his nights in bed.

Mr. Millet was evidently responsible for the several observations as to the habits of tiger. 'The tiger tears off the skin (of a carcase) like tissue paper'; 'if hungry they come with a roar and throw themselves upon the carcase'; a female of this species gives birth at irregular intervals, often several years apart, and takes care of the little ones for a time, moving them from place to place. A singular instinct then causes her to eat all but one of the babies a saving grace for the rustics, otherwise the country would be overrun with tigers'. These are truly remarkable Natural History observations.

It is seen by the measurements given that the Annam tiger is a lightly built animal as compared with the tiger of India. The largest shot had a body length of 5 ft. 11 in. with a girth of but 41½ in. There appeared to be a great many tigers in that country, many of them maneaters, and 'there is a vast supply awaiting the generations to come'.

'Kirkendall and Millet celebrated the Fourth of July by killing four gaur and wounding a fifth (one allowed on the license!) practically demolishing a herd'; and again, 'Kirkendall and Millet had the good luck, during a day on which I had chosen to stop in camp, to fall in with a troop of gaur . . . Three cows and an exceptionally heavy bull paid the penalty, while a second bull dragged itself off sorely wounded'; once more, 'Kirkendall at length covered himself with ambiguous glory by killing an adult cow (wild cattle) and mortally wounding another' and lastly, 'Kirkendall fired four times landing once through the intestine. That he died of gangrene there is no question'. 'Kirkendall, insatiable . . . . amused himself at Da-Nhim in pursuing *con-nai* (sambur) at night with an electric torch device pinned on his campaign hat. There is no law against it as in most other countries in the world . . . . His first evening's "jacking" was a towering success; he bagged a full grown buck and doe with two shots along the maccadam road'.

Enough of this butcher Kirkendall. It is a thousand pities that A. H. had him with him on this trip. It must not be thought that Harrison intentionally pillories his friend; the book does not in the remotest degree read like that. The best of two gaur bulls had a spread of 38½ in. A. H. was himself a good sportsman. All through the book there are remarks and observations which clearly indicate that he was a forbearing sportsman with no desire for unnecessary slaughter. He shot two of the tigers, a bull gaur, and a bull *kron* (wild cattle). Only once did he fire at a deer the whole trip and shot no sambur, going home with but an old horn or two picked up in the woods. It is good to read that the party did not fire at the brow antler deer, of which there were plenty. Millet was the formulator of the recently introduced game laws yet, 'Our guardian even pulled off a fine shot himself at a doe (sambur) at three hundred yards'.

The chapters on 'Miscellaneous Game', 'Camps and Side Issues', 'Mois, Annamites, and Generalities', are readable and informing on many matters.

The American rifles were found to shoot high and there were futile stalks and days of hunting owing to want of knowledge of what the rifles would do; 'They shot high at from 50 to 200 yards. It took us some weeks to get in the habit of proper allowance'. They found the bulls of the wild cattle more difficult to come by than the bison. The photographs do not show that heads much worth having were obtained.

Villagers are restricted to native arms—spears and cross-bows,—and are no doubt adepts in the use of poisoned arrows, for they trade largely in skins. They are not permitted to trap, but one reads elsewhere that they are expert trappers.

In this Review pretty well all that calls for remark has been noticed, and it is because the book is not available to the general public that it has been treated at such length.

Archibald Harrison was a man of lovable character. He died at the comparatively early age of fifty-two.

R. W. B.

### IV. 'DARWIN'. By R. W. G. Hingston (Duckworth, London. 2s.).

The readers of the Society's *Journal* need no introduction to the author of the volume under review; his delightful series of articles on the life and biology of spiders, ants and other insects published in the *Journal* a few years back are well known to all of us. He is also the author of 'A Naturalist in the Himalayas', 'A Naturalist in Hindustan', and 'A Naturalist in the Guiana Forest'.

The work under Review is the first attempt by the author in the biographical line. It contains a careful and fairly detailed account of the life and work of the great naturalist and biologist, Charles Darwin, and is one of the series of small volumes entitled 'Great Lives' published by Messrs. Duckworth & Co. Each of these volumes reviews briefly the life and work of celebrities in various branches of learning, Art and Science, and provides at a moderate price handy biographies such as should enable the lay public to get an idea of the life and work of these great men.

Hingston's 'Life of Darwin' is not planned on the ambitious scale of the famous biologist's life in three volumes edited by his son Francis Darwin, but deals in six chapters with his ancestry, early years, schooling, University education, and traces the history of his monumental work in connection with the theory of Evolution. Darwin's father, who was himself a successful physician, wanted that his son should follow in his footsteps, but after repeated attempts both in Shrewsbury Grammar School and later in the University of Edinburgh he found it impossible to carry on with the training necessary for a medical student and after long cogitations the clerical profession was decided upon. With this end in view he shifted to Cambridge, but was only able to get an ordinary B.A. degree. During his stay at Cambridge, however, he under the guidance of Henslow and Sedgwick had obtained a general, though not intensive, training as a naturalist. Fortunately for Natural History, the Admiralty brig 'Beagle' was about this time starting on its round-the-world voyage, mainly for the survey of the South American coast line but also intending to carry round the world a chain of chronometrical measurements. As the author very rightly points out, Darwin when he set out on this voyage, was totally unacquainted with his powers and only expected 'to accumulate collections for the big guns to classify in obscure periodicals', but in his new school on board the 'Beagle' 'he developed with riotous precocity' and collected material which provided the necessary withal not only for the wonderful account of 'A Naturalist's Voyage Round the World', but also the materials for his theory of the formation of Atolls and Coral Reefs and geological observations on volcanic islands etc. It was during this voyage that Darwin had begun to consider the problem of the origin of species and its bearing on Evolution. 'Darwin did not initiate the idea of Evolution. What he did was to resurrect it and demonstrate its truth' by careful studies on domestic animals and several years of 'pondering and investigation'. In three chapters Hingston gives a most delightful summary of Darwin's work not only as a zoologist but also as a geologist, botanist and, above all, a biologist with an exceptionally fruitful mind for discovering and collating the facts involved in the study of Evolution.

The little book is written in a delightful style and both the author and the publishers are to be congratulated on a beautifully got-up volume which they have been able to produce in such a short compass and at so low a price.

B. P.

# OBITUARIES

## ETHELBERT BLATTER, S.J.

It is with the deepest regret that we record the death of Reverend Father Ethelbert Blatter, who passed away peacefully on Saturday evening, the 26th May (1934) at 6-45 p.m. at St. Vincent's High School, Poona.

Father Blatter was born in Switzerland on the 15th December, 1877. The Blatters hail from the Swiss Canton of Appenzell stretching around the slopes of the majestic Saentis. He lost his father very early in life and grew up in the castle above the village of Rebstein, in the valley of the young and boisterous Rhine. The Rebstein Castle belonged to Fr. Blatter's uncle, a very popular doctor in that corner of the Canton of St. Gall. After the death of Dr. Blatter, the romantic place, which had been built in A.D. 1207, was acquired by a charitable industrialist of Rebstein and is now a boarding house for factory girls in charge of motherly nuns.

After his elementary education in the village school, young Ethelbert went to the college (high school) of Sarnen, in the Canton of Obwalden, in Central Switzerland. Classmates still talk of the brilliant youngster who simply played with every subject of the classical course, and quite as readily with the good Benedictine Fathers. But all are agreed that there was a certain frank nobleness about the jolly schoolboy. His countless pranks were conceived in the spirit of fun and hurt nobody. He was bursting with buoyancy and could not suppress the Appenzeller in him. The Appenzellers are renowned for their wit, and famous for their quick repartee. Blatter excelled in both. The last years of student-life he spent in the college of Schwyz at the foot of the imposing twin peaks of the Mythen. A colleague referring to this period (Schwyz) writes: "There I came to know him, when I was still in the 'small division'. Ethelbert was soon the hero of the school as he had been at Sarnen. He was easily first in class, and on the stage, and . . . would you believe it?—could run in the playground like a deer, although his physical proportions were relatively the same as when he was the Reverend Principal of St. Xavier's College, Bombay. Only those who did not know young Blatter sufficiently were astonished, when from Schwyz he went to Feldkirch in Austria to join the Noviciate of the German Province of the Society of Jesus." It was very often jokingly said that young Blatter had been in every school in Switzerland.

Blatter joined the Society of Jesus on the 1st October, 1896. Two years later he went to Holland to brush up his classical studies. At that time the German Jesuits were in exile under the Bismarckian law, and the so-called Juniorate was a very lonely place in the Dutch heath. Philosophy followed in the fine college of Valkenburg, somewhat closer to the German frontier and quite

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near the snug town of the Dutch Limburg. In 1903, during the interval between philosophy and theology Blatter came to India for the first time. A companion writes: "Probably in quiet Holland he had chosen botany as his 'hobby'; but he would have been equipped for anything else in positive science, not so for merely speculative learning. He always liked to poke fun at the deep thinkers, who never returned to the realities of creation." However, from Blatter's own words, his botanical instinct had its origin much farther back. He had studied the flora of his native hills in boyhood and could name almost all the local plants, not only by sight but by taste. He had also acquired a sound knowledge of zoology and geology; but realising that he could not do justice to the three subjects at the same time, he concentrated on botany. He joined St. Xavier's College as Professor of Biology.

As a scientist he had already been very active in Europe. Wherever there was an important scientific congress, Blatter was sure to be there, his command of several European languages always stood him in good stead. Blatter related with much amusement an incident at one of these learned gathering. Returning home late one night from a congress meeting in Brussels he was accosted in a back street by a fellow who became abusive. Soon the Appenzeller awoke, and Blatter felled the ruffian who rolled into the gutter like a log. Next morning in the papers he read to his horror that in the night a man had been kiled in the street. Out went Blatter to see where he had knocked down his man. To his great relief he found that the reported fatality had occurred in another part of the town and that he was not 'wanted'. It was never advisable to fool with Blatter neither with the Swiss nor with the Jesuit.

Soon after his arrival in India, Blatter joined the Bombay Natural History Society. He was elected a member on the 19th January, 1904, and began soon after to contribute important scientific articles to the pages of the Society's *Journal*. His first article was entitled *The Fauna and Flora of our Metalic Money* (1). This was followed by others in quick succession. A list of his numerous publications on Indian and Asiatic Botany appears at the end of this obituary. During his stay in India he travelled much to different parts of the country, and made collections which formed the basis of all his writings. His most important contribution between 1904-1909 was a series of articles which appeared under the title of *The Palms of British India and Ceylon, Indigenous and Introduced* (17). This was subsequently published in book form by the Oxford University Press (29).

In 1909 Blatter returned to Europe to complete his ecclesiastical studies. By this time he had acquired that remarkable knowledge of the flora of India which was to help him considerably later on, and was to stamp him as one of the greatest systematists in the Indian field. Moreover, he had gathered around him a wide circle of friends who were sorry to lose him, and whom he was loath to quit.

From Bombay Blatter went to Hastings where the exiled Jesuits of two French Provinces had opened a house of theology.

During the early days of the war—when many of the English Jesuits joined up as Military Chaplains, Blatter had to resume his priestly duties. He was for some time chaplain to the Dowager Duchess of Sussex. Blatter used to relate with loud laughter how the noble lady was wont to apportion him a single slice of meat which she carved in truly ducal manner from the daily shoulder of mutton. She considered this ample fare for an obviously over nurtured Jesuit. Unable to agree with her judgement of his capacity as a good trencherman, Blatter, unknown to the Duchess, was compelled to go to the local inn to supplement Her Grace's ration with more generous, if more plebian fare.

During this period of absence from India Blatter was a frequent visitor at Kew, where he spent much time compiling the *Flora of Aden* (23). At Kew he made numerous friends among the staff of the Herbarium, and they were to prove very helpful to him after his return to India.

Blatter was ordained priest on the 25th August, 1912, after which he spent another year in Holland and there for the first time felt that his health was no longer good. Before leaving a second time for India he went for special studies to London and compiled the *Flora Arabica* (28). He was in London when the Great War began. Hearing of the difficult position of the Bombay Mission, he secured a passage on a Japanese boat, passed through the Suez Canal through Turkish rifle fire and eventually landed in Bombay in October 1915. He had undertaken the second journey contrary to medical advice, but he knew that his superiors wished him to help the much tried Mission, especially St. Xavier's College. More than once, before and after that, Fr. Blatter had occasion to show his spirit of religious obedience; however much he might detest to be bothered with trifles, he knew his duty and never flinched.

On his return to Bombay he once more took up the Professorship of Biology at St. Xavier's College. He built up extensive collections, chiefly of botanical material, and thanks to him, St. Xavier's College is now the proud possessor of one of the finest herbaria in Western India. He travelled extensively in different parts of the country. In 1916 he was elected a member of the executive committee of the Society. In 1919 he was appointed Principal of the College, but though this honour hampered his botanical activities to a great extent, he nevertheless remained in his professorial chair till 1924. He was also a prominent member of the Bombay University Senate, and as such he had much to do with the present University Reforms. In 1925 he retired to Panchgani as Parish Priest, and this gave him ample opportunity to pursue his botanical studies. In 1930 while on an expedition in Waziristan he had a bad fall from his horse which resulted in a slight concussion of the brain and brought on partial paralysis. From this time though he still carried on with his botanical studies his health began to fail. In 1926 Fr. Blatter was elected a Vice-President of the Society. He was also on the Society's Advisory Board, and his sound advice and forceful arguments always carried much weight. In his death the Society has lost one of its ablest members and advisers, and India loses a great man who has done much for the country of his adoption. He was loved by members of every community, and large is the circle of friends and admirers who mourn his loss.

In recognition of his botanical work Fr. Blatter received the Johannes Bruehl Memorial Medal for the year 1931. The announcement was made at the Annual Meeting of the Asiatic Society of Bengal held on Monday, 1st February, 1932. The award was made in recognition of his 'Conspicuous Important contributions to the knowledge of Asiatic Botany'. Fr. Blatter was the first to receive this medal. He much appreciated this recognition of his efforts, and was really proud of it, as it was the only acknowledgement he ever received for the vast amount of work he had done for India. Strange to say honours did not come his way and, in the words of one of his friends, 'the familiar of three Governors, the eminent botanist, the educationist of no mean standing died plain Father Blatter'. Fr. Blatter's death ends the long line of the Blatter family as he was the only son and only survivor.

None who knew him will forget this loveable man. Under an ever joyous and ever ebullient surface there lay a deep, sensitive, almost melancholy soul, full of sympathy with the sufferings and hardships of others, ready to help even with imprudent liberality. Young and old, great and small, came to him and were the better for it.

Simple of heart he loved children. They flocked around him and clambered about him unafraid. About Xmas he would acquire a pile of children's annuals and gift books, and derive as much pleasure in the reading of them as did the little friends to whom he gave them. Nothing, not his successes nor his disappointments could suppress the boy in him.

Those who were unable to understand the man shook their solemn heads when he appeared to strain the limits of their narrower decorum. Then he was perfectly capable of going yet further purposely to shock the stiff guardians of the literal law. Thus he acted as a boy, thus he continued as a man. He cared nothing for mere disciplinarians. But he died as he lived faithful to the spirit of religious obedience and to the high traditions of his priestly order. His was a great heart. Of Blatter one might truly say:—

"His life was gentle; and the elements
So mix'd in him, that Nature might stand up,
And say to all the world, '*This was a man!*' "

The Office of the Society was closed for half the day on Monday the 28th May as a mark of respect for its late Vice-President.

C. McC.

## LIST OF SCIENTIFIC PUBLICATIONS.

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2. The Mangrove of the Bombay Presidency and its Biology. *Ibid.*, xvi (1905), 644-656.

3. The 'Pectinate Organs' of Trapa bispinosa. *Ibid.*, xvii (1906), 84-88.
4. Flowering Season and Climate. *Ibid.*, xvii (1906), 334-350, 697-708.
5. The Student's Companion in the Study of the Natural Orders in Botany. Bombay, 1906. Second Edition, 1916.
6. Practical Petrography. Bombay, 1907.
7. Acta et Agenda by the Bombay Botanists. *Journ., Bom. Nat. Hist. Soc.*, xvii (1907), 562-577.
8. The Flora of Aden. *Ibid.*, xvii (1907), 895-920, xviii (1908), 54-68.
9. Cassia renigera. *Ibid.*, xvii (1907), 1036-1037.
10. The Flora of the Bombay Presidency, Statistico-Biological Notes. *Ibid.*, xviii (1908), 562-571.
11. Caterpillars as Ants Pets. *Ibid.*, xviii (1908), 591-595.
12. The Ferns of the Bombay Presidency. *Ibid.*, xviii (1908), 599-612.
13. Ceylon Ferns in the Bombay Natural History Society's Herbarium. *Ibid.*, xviii (1908), 639-648.
14. Contributions to the Flora of North Coimbatore. *Ibid.*, xviii (1908), 390-429.
15. On the Flora of Cutch. *Ibid.*, xviii (1908), 756-777, xix (1909), 157-176.
16. The Flora of Panchgani. *Ibid.*, xix (1909), 314-332.
17. The Palms of British India and Ceylon, Indigenous and Introduced. *Ibid.*, xx (1910), 33-64, 347-360, xx (1911), 675-705, 981-995, xxi (1911), 66-86, xxi (1912), 343-391, 912-968, xxii (1913), 67-86, 444-463, xxii (1914), 665-681, xxiii (1914), 269-281, xxiii (1915), 516-531, 737-744, xxiv (1916), 329-340, 507-538, 673-688, xxv (1917), 52-62, 207-230, xxv (1918), 386-415.
18. History of the Sea Cocoanut (*Lodoicea seychellarum*). *Ibid.*, xix (1910), 925-937.
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21. A Bibliography of the Botany of British India and Ceylon. *Journ., Bom. Nat. Hist. Soc.*, xx (1911), lxxix-clxxvi.
22. A List of Indian Fungi, chiefly of the Bombay Presidency, with a description of two New Species. *Ibid.*, xxi (1911), 146-152.
23. Flora of Aden. *Rec. Bot. Surv. India*, vii (1914-1916), 1-418. Calcutta.
24. Scorpion Sting and Garden Rue. *Journ., Bom. Nat. Hist. Soc.*, xxiv (1916), 839-843.
25. Plant Types for College Students. Examiner Press, Bombay, 1917. Third Edition, 1928.
26. The Edible Date Palm in Bombay. *Journ., Bom. Nat. Hist. Soc.*, xxvi (1918), 306.
27. Oleander Poisoning Camels. *Ibid.*, xxvi (1918), 306-309.
28. Flora Arabica. *Rec. Bot. Surv. India*, viii (1919-1923), 1-450. Calcutta.

29. The Palms of British India and Ceylon. Oxford University Press, 1926, xxviii, p. 600, pl. 106.
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31. Revision of the Flora of the Bombay Presidency. *Journ., Bom. Nat. Hist. Soc.*, xxxi (1926), 547-557, xxxi (1927), 897-917, xxxii (1927), 14-33, 281-298, xxxii (1928), 408-435, 622-649, xxxiii (1928), 7-25, xxxiii (1929), 229-243, 480-496, 753-775, xxxiv (1930), 12-25, 291-306, 623-637, xxxiv (1931), 877-900, xxxv (1931), 13-31 with 7 plates, 254-275 with 8 plates and 6 text-figs., xxxv (1932), 484-495 with 3 plates and 1 text-fig., 722-736 with 4 plates and 1 text-fig., xxxvi (1933), 12-28 with 9 plates, 307-320 with 2 plates, 524-537 with 2 plates, 781-795 with 1 plate and 1 photo, xxxvii (1934), 15-35 with 3 plates.
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35. List of Orchids with some New Species from the High Wavy Mountains (Madura District). *Journ., Bomb. Nat. Hist. Soc.*, xxxii (1928), 518-523.
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37. A New Species of Balanophora from Mahableshwar, Bombay Presidency. *Ibid.*, xxxiii (1929), 309-310.
38. Mosses of the Bombay Presidency, the High Wavy Mountains and Mt. Abu. *Ibid.*, xxxiii (1929), 869-879.
39. The Flowering of Bamboos. *Ibid.*, xxxiii (1929), 899-921, xxxiv (1930), 135-141, 447-467.
40. The Indian Bamboos brought up-to-date. *Indian Forester*, lv (1929), 541-562, 586-613.
41. Revision of the Genus Butea Koen. *Journ., Ind. Bot. Soc.*, viii (1929), 133-138.
42. The Indian Species of Terminalia Linn. *Journ., Ind. Bot. Soc.*, viii (1929), 245-262.
43. A proposed Revision of the Flora of British India. *Ibid.*, ix (1930), 140-150.
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47. New Species of Indian Plants. *Journ. and Proc., Asiatic Soc. Bengal* (New Series), xxvi (1930), 339-366.

48. Some Notes on the Flowering of Bamboos. *Journ., Bom. Nat. Hist. Soc.*, xxxiv (1931), 1097-1099.
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50. A New Gentian from North Waziristan. *Journ., Bomb. Nat. Hist. Soc.*, xxxv (1932), 891.
51. A Plantago New to the Bombay Presidency. *Ibid.*, xxxv (1932), 915.
52. New Plants from Waziristan. *Ibid.*, xxxvi (1933), 477-484.

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65. A new Ceropegia from the Western Ghats. *Ibid.*, xxxiv (1931), 936 with one plate.

66. Another New Ceropegia from the Western Ghats. *Ibid.*, xxxv (1931), 409 with one plate.
67. A New Indian Species of Begonia. *Journ., Ind. Bot. Soc.*, x (1931), 27-28 with one plate.
68. Two New Utricularias from the Western Ghats. *Ibid.*, x (1931), 122-125 with 4 plates.
69. Fruit of Cryptocoryne tortuosa Blatter & McCann. *Journ., Bomb. Nat. Hist. Soc.*, xxxvi (1933), 760.

Blatter, E. & Fernandez, J.:—

70. Waziristan Mosses. *Journ., Ind. Bot. Soc.*, x (1931), 145-153.
71. The Flora of Waziristan. *Journ., Bom. Nat. Hist. Soc.*, xxxvi (1933), 665-687 with one map and one plate, 950-977 with two plates, xxxvii (1934), 150-171 with two plates.

Blatter, E. & Millard, W. S.:—

72. Some Beautiful Indian Trees. *Journ., Bomb. Nat. Hist. Soc.*, xxxiii (1929), 624-635 with 2 colour-plates, 2 black-and-white plates and 4 text-figs., 851-856 with 2 colour-plates, 2 black-and-white plates and 5 text-figs., xxxiv (1930), 83-86 with 2 colour-plates, 2 black-and-white plates and 4 text-figs., 271-273 with 2 colour-plates, 2 black-and-white plates and 4 text-figs., 716-719 with 2 colour-plates, 2 black-and-white plates and 5 text-figs., xxxv (1931), 60-65 with 2 colour-plates, 2 black-and-white plates and 5 text-figs., 289-296 with 2 colour-plates, 3 black-and-white plates and 7 text-figs., xxxv (1932), 525-529 with 2 colour-plates, 2 black-and-white plates and 6 text-figs., 824-825 with 1 colour-plate, 1 black-and-white plate and 2 text-figs., xxxvi (1933), 139-140 with 1 colour-plate, 1 black-and-white plate and 2 text-figs., 353-355 with 1 colour-plate, 1 black-and-white plate and 2 text-figs., 521-523 with 1 colour-plate, 1 black-and-white plate and 2 text-figs., 778-780 with 1 colour-plate, 1 black-and-white plate and 3 text-figs., xxxvii (1934), 36-37 with 1 colour-plate, 1 black-and-white plate and 2 text-figs.

## ERNST JOHANN OTTO HARTERT.

Through the death of Dr. Ernst Hartert on November 11, 1933, Ornithological Science has lost one of the most outstanding systematic workers in the last fifty years. Born on October 29, 1859 at Hamburg, where his father a Major in the Hanseatic contingent was then living, young Hartert from his earliest age showed a great taste for Natural History. As a schoolboy he began forming a collection of eggs which he greatly added to while a student at Konigsberg.

When twenty-five years old he was attached as volunteer zoologist to an expedition sent out to explore the Niger and Benue basins in West Africa and after a year and 4 months' absence returned to Germany *via* Sierra Leone. In 1887 he undertook a second expedition and this time went to the East Indies to collect beetles and butterflies. Most of his collecting was done in Sumatra and returning from thence to Penang he met William Doherty, the American collector, and arranged with him to go to Tibet. Owing, however, to troubles in Sikkim the collectors were unable to reach Tibet and instead went to Assam and the Naga Hills, hoping to penetrate into the Mishmi country, but were prevented from doing so by the authorities. The principal aim of this journey was to collect insects, but Hartert paid considerable attention to birds and published some interesting notes on the species met with in the *Journal für Ornithologie* for 1889. On his return to Germany he undertook the preparation of a catalogue of the birds in the Senckenbery Museum which was published in 1891. In the same year he married and came to London at the invitation of Dr. Günther to write the Swifts and Goatsuckers in vol. xvi of the Catalogue of Birds in the British Museum. When he had completed that work he was commissioned by Lord Rothschild and Count Berlepsch to make a collection of birds and lepidoptera in Venezuela and sailed for that country, accompanied by Mrs. Hartert, in 1892. Owing to a revolution in Venezuela he was unable to collect there and instead went to the Dutch West Indian Islands of Curacao, Aruba and Bonaire where he made valuable collections of which he gave an account of the birds in the *Ibis* for 1893.

Returning to England in the Autumn of 1892, he was appointed by Lord Rothschild to take charge of the Zoological Museum at Tring, which post he held till his retirement in 1930. During his long curatorship at Tring, Dr. Hartert assisted Lord Rothschild to build up the magnificent collection that Museum has long been famous for. As new collections were received they were reported on by Dr. Hartert in the Tring Museum Journal, *Noviates Zoologicae*, and from 1894 till his retirement a steady stream of papers appeared from his pen. In spite of the enormous number of specimens received yearly at Tring, Dr. Hartert kept the collection in perfect order and had an extraordinary knowledge of the specimens under his care.

He was greatly interested in the birds of the East Indian Islands and New Guinea, but it was the great Palaearctic region in which his chief interest lay and it will be by his book on the birds of that region that he will be principally remembered.

After the Pastor Brehm collection had been acquired, Lord Rothschild, with Dr. Hartert's assistance, started to bring together the unique collection of Palaearctic birds at Tring on which the latter's well known book *Die Vögel der paläarktischen Fauna* was based. The first part was published in November 1903 and was completed in 1923 with a supplement in 1923. Two parts of a further revision were published, in conjunction with Professor Steinbacher after his retirement, a third appearing a short time after his death.

While this work was in progress Hartert made several trips to Europe to collect additional material and, accompanied by Lord Rothschild and at other times alone, he made some ten trips to North Africa, exploring the Avifauna from Morocco to Cyrenaica.

Although trinomials had been recognised in England before Hartert came to Tring it may be said that he was mainly responsible for the introduction of subspecies and the study of geographical races, which he did in the face of much opposition from the older ornithologists. But though the controversy was often rather bitter, Dr. Hartert never allowed it to affect his personal relationships with his fellow ornithologists. By the continual advocacy of his views he gradually convinced the younger ornithologists of the value of trinomials for denoting geographical races and by the time the first part of the Handbook of British Birds was published, all opposition had died down.

Hartert was keenly interested in other branches of Natural History, and had made a special study of beetles of the genus *Carabus*. He was a very careful and painstaking collector and had a wonderful knowledge of the birds of the world and the literature concerning them, which was always at the disposal of others. After his retirement we greatly missed his monthly visits to the British Museum, when the latest ornithological news was discussed and specimens from Tring compared with others in the British Museum.

N. B. K.

## FRANCIS JAMES MITCHELL.

Frank Mitchell (as he was better known among his friends) was born at Saucheri, Ayrshire, Scotland. He was educated at the Madras College, St. Andrew's and in 1873 at the age of 18, came out to India to join his brothers in a contracting and brokering business at Cawnpore. Then followed years of strenuous effort, among them the period of the great famine, when Mitchell was instrumental in supplying quantities of wheat to the Government for the relief of distress. Always a pioneer, ready to grapple with fresh enterprise, he conceived the idea of exporting wheat from India—a successful trial shipment to England resulted in the opening up of the export trade of Indian wheat.

Other important works of lasting benefit to the country in which Frank Mitchell was concerned with his brothers was the building of the Bengal-Nagpur Railway and the construction of the Jhelum Valley Road from Khola to Srinagar.

Subsequently Frank founded a brokering business in Bombay under the name of Mitchell & Co. About 1890 he retired from India a fairly wealthy man. Speculation in S. Africa practically ruined him. A friend relates that Mitchell was shooting in Scotland when he received a wire to say that he was ''broke''. Mitchell shot his best that day and topped the bag and returned to London, financially ruined but not in spirit. When hearing of men in financial distress committing suicide he would say 'I know what it is like, something hits you hard in the middle and it's the very devil to face the future'. Undaunted by his losses, Mitchell came out to India again in 1900, accepting a job in his brother's carpet factory at Srinagar on a salary of Rs. 200. The business was in low water, but Frank devoted his talents and energy to it. He travelled in Persia, Turkey and other countries, studying the methods of using vegetable dyes and finally succeeded in exhibiting his carpets at European exhibitions, and opening up a wider market for the Kashmir product.

Later he interested himself in olive culture in Kashmir and the Punjab. While studying on behalf of the Government the possibilities of olive growing in the Punjab and establishing an olive plantation at Kahire Murat near Rawal Pindi he also investigated the possibilities of working petroleum oil. His energies in this direction brought about, with the help of Sir Louis Dane, then Lt.-Governor of the Punjab, the formation of the Attock Oil Company Ltd. which he successfully floated in London just before the outbreak of the war.

In 1920, Frank Mitchell took over 700 acres in the Lower Bara Doab Canal Colony, Montgomerry District, and started the plantation of over 400 acres of fruit now known as the Indian Mildura Fruit Farm Ltd.—one of the largest fruit farms in India. His work in this connection has done much for the development of fruit culture in the Punjab and has been of benefit to the Province.

His leisure hours in Kashmir were spent in various hobbies, such as pheasant rearing and fish culture. He, it was, who conceived the idea of introducing Trout into Kashmir and he helped to found the Kashmir Trout Fishing Club. The excellent sport now available to Fly fishers in the State is due mainly to his unremitting effort. On behalf of this Club he undertook to obtain Trout ova while on a visit to England. This success was made possible by the assistance given him by the Duke of Bedford who arranged for supplies from his Devonshire estate near Tavistock. The first consignment of ova was not very successful, but Mitchell tried again. He met the second consignment at Bombay and personally looked after its transport to Kashmir. The ova eventually hatched out at Harwan and the Dochigan river was stocked. Hatcheries established by him at Harwan and Achibal have supplied the stock for most of the Kashmir rivers and lakes. Mitchell trained the local men in trout culture and taught them the work from spawning to distribution of yearlings. His story of how Trout were introduced into Kashmir was published in the *Journal* (vol. xxxvi, p. 295).

Mitchell was an old valued member of the Society. He published various notes in the *Journal* mainly dealing with fish and fish culture but it was always difficult to induce him to write. One of the many things which he did for Kashmir which he so loved was to arrange with his friend, the late Fr. Blatter, for the publication of a work on the Beautiful Flowers of Kashmir which Mitchell financed. Two volumes have been published and the third was being considered; but death has now removed both the author and the inspirer of this fine work.

A genial loveable man, Frank Mitchell endeared himself to all with whom he came in contact. He was always a welcome visitor to the Society's office, never failing to come in when passing through Bombay. In spite of his age he was ever active, ever planning fresh projects and actively developing the enterprises he had in hand. He was happy in his many activities to the very end. He died at Baramulla, Kashmir on 20th November, 1933. He served India well and his loss will be regretted not only by his many friends but also by many a humble peasant. For besides his many abilities he had just those qualities which endear the best type of Englishman to the Indian villager.

## HEUGH S. SYMONS.

### AN APPRECIATION.

BY A CONTEMPORARY OF HIS SON.

A large circle of friends outside Devon and Cornwall will hear with deep regret of the death of Heugh Symons, of Hatt. The knowledge that he died after but a few days' illness, as he would himself have wished, and that he was well and active up to and after his eightieth birthday, will be some slight consolation.

It is not my intention to write of his life at Hatt, the home of his childhood which, after various vicissitudes, he bought back in 1903 and where he retired to live when he finally came home from Bombay in 1914. It was undoubtedly a cherished hope of his that he would in due time be succeeded at Hatt by his only son, Hubert. Fate decreed otherwise, for Hubert was killed in March, 1918, commanding his battery in France, and his father never, I think, quite got over his loss.

Rather would I recall some of the old days in Bombay—days of which he was never tired of talking. There was plenty to talk about, for during his thirty-eight years in India, all but the earliest of which were spent in Bombay, he filled every moment he could spare from his business with some form of sport. His business he did not talk about; on his sporting experiences it was quite easy to get him started. Polo he did not play, partly because of his weight, but principally, I think, because he preferred to get out into the jungle and find his recreation there.

When speaking of pig-sticking, he was wont to belittle his own performances and to aver that he was not in the same class as his brothers, Nick and Jack. Possibly he was correct in his estimate. The two elder brothers that he so admired were amongst the *elite* of the pig-sticking world on the Bombay side in the eighties, having each won several Bheema Cups and also being credited with one Guzerat Cup each. In fact, in 1886 Nick only won the latter trophy after dead-heating with his brother Jack in the final and having to run it off. Surely a family record in the pig-sticking world! Nick also held the distinction of being one of the few men who are known to have ridden down and killed a full-grown wolf single-handed. The head of that wolf is at Hatt now.

A man might well not be in the same class as these two giants and still be considered a good man to pig. Mention of his brothers reminds one that Heugh, a modest man if ever there was one, was somewhat inclined to boast about one fact. That fact was that the four brothers, the fourth being General Pen Symons, killed in South Africa, had only five eyes between them. The soldier was the only one that had the full allowance. Each of the other three, Heugh from infancy, the other two owing to accidents with gun or spear, had only one apiece!

Riding to hounds with the Bombay or Poona and Kirkee, Heugh was, even when well on in years, most emphatically a 'bad 'un to beat'. Always well mounted and thoroughly appreciating a good horse, he yet did not hunt to ride. He loved watching hounds and observing the various signs of wild life that were to be seen on those early morning hunts by those who knew how to use their eyes. He saw more out of one eye than the majority of people did out of two, and it was always a joy to hear him describe a day's hunting.

Keen as he was on hunting, it was on shooting that his heart was most firmly set, especially during his later years out there. What he did not know about the snipe ground within reasonable distance of Bombay was literally not worth knowing. He was a noted shot in a land of good snipe shots, and on could be quite sure that if anybody got a good bag, Heugh Symons would get as good or better.

As a man, his popularity with seniors and juniors alike was firmly established on the sure foundation of his personality. Speaking as one of the juniors, I can testify to his sympathetic good fellowship. Always ready to join in a 'rag,' he was never so happy as when surrounded by a gang of cheerful youngsters, and they were just as happy to have him in their midst. One felt instinctively that if in a difficulty his help and advice would be generously given for the asking, and that they would never be forced upon one unasked. In that probably lay the secret of the bond between him and younger men.

One thing he could not abide was a slacker. Whether at work or play, he had always 'gone sixteen annas' himself and had no sympathy for anybody who did less.

To the end of his days he was an outstanding example of unbounded energy and of good sportsmanship in the best sense of that much abused term. The world is the poorer for his leaving it.

—(*The Gazette*, December 7, 1933).

# MISCELLANEOUS NOTES.

## I.—THE INDIAN VAMPIRE (*MEGADERMA LYRA*) FEEDING ON A PIPISTREL.

It is well-established that the Indian Vampire Bat is carnivorous, feeding chiefly on small bats and birds, but I record the fact once more as I actually saw this bat capture a Pipistrel in flight. There are several records in the *Journal* dealing with the food of the Indian Vampire (see vol. xvii, pp. 835, 1021).

While sitting by the bedside of a sick man one evening, a Pipistrel entered the room at about eight o'clock, the light was on. It seemed to be in an awful hurry, circling round the room at 'full speed'. Shortly after it entered, in came an Indian Vampire Bat and immediately chased the Pipistrel. The chase lasted about a minute before the Vampire caught the smaller bat. The Vampire carried the Pipistrel about for a little while, but in trying to get out of the door it dropped its prey. It re-entered the room to recover the lost meal, but as I had risen from my seat it took fright and left altogether. This observation was made in Poona.

Bombay Natural History Society,
Bombay.
*January* 25, 1934.

C. McCANN,
*Asst. Curator.*

## II.—AN UNUSUAL TIGER.

The northern part of the Jaipur State is composed of two districts called Shekhawati and Torawati, the first of which consists mainly of sandy desert, and the second of bare stony hills, and a less likely area in which to get tiger, it would seem hard to find. Nevertheless in the year 1931 from reports received from villagers of cattle being killed and people being mauled, it became evident that a tiger had taken up its home near a place called Buchara, on the borders of Khetri, an important Chiefship in the Jaipur State, and as the Superintendent of Khetri had kindly offered to pitch a camp there, I decided to make an effort to shoot it. His Highness the Maharaja not merely gave the required permission, but was good enough to lend the help of the State Shikar Department, some of the shikaris from which were sent on ahead to make the local arrangements. As soon as word came in from them that there had been a kill and the tiger had been located, I set out for Buchara accompanied by my wife, and was there met by the Superintendent and his wife, and the minor Raja of Khetri. We reached Buchara in the morning and rode out to see the reported kill. We found on arrival that there had been no less than five kills during the night all within a short distance of each other. The Shikaris were of opinion that there were two tigers, because of differences which they alleged to exist in the various pug marks in the loose sand that had been strewn round the kills. Although it is very unusual for a tiger to be so destructive, it seemed doubtful whether there was more than one tiger concerned, as the differences in the pug marks resembled those which would normally occur between the front and hind paws, and what happened subsequently suggests that this view was right. The country round Buchara consists of sand broken by rugged hills and is almost treeless. About a mile above the places where the tiger had killed there is a big embankment between two hills which impounds a lot of water during the rainy season, and the seepage channel for a mile or so below the embankment is marked by a dense growth of reeds about 6 ft. high, interspersed with occasional pools of water. This channel has fairly well-defined banks some 4 or 5 ft. high, and only at one place near the scene of the kills were there any trees, two small babul trees on the far bank. A machan had been prepared on one of these trees by the shikaris, but as our party was too large for one machan, we had a second one hurriedly constructed on the other babul tree. The Superintendent and I then rode back, intending to commence the beat after lunch. At 12-30 however word was brought that the tiger was on the move and so without waiting for lunch we proceeded to our machans. The beat began at a point some 500 or 600 yards distant on the other bank and was directed diagonally across the channel, as this was necessary to bring the tiger near the machans, and it looked as though the whole affair would be over in an hour at most. We had an army of coolies and 5 elephants; and a number of stops were also placed all round. Some avenues had been cut through the reeds, one of them right opposite the machans in order to make the tiger expose itself.

Shortly after the beat started the tiger was seen to cross one of the further avenues, and dive into the big block of reeds that came right up to our machan. We could occasionally see a slight movement of the reeds as the beat advanced, and eventually the tiger reached a point not more than 75 yards from the nearer machan, but without ever having exposed himself to view. As the beat closed in towards the machans, the beaters fell in behind the elephants, and it was just as well they did so, as the tiger then made three determined rushes on the elephants, upsetting their equilibrium badly. In spite of having been warned and the obvious danger, one or two Naga[1] beaters however advanced beyond the elephants and the tiger charged them, mauling one man rather badly. He would have been killed but for the fact that one of the other Nagas in the confusion fell on the top of the tiger so frightening it off. The beat was then stopped, and as it was clear the tiger was in a dangerous mood and unwilling to come forward, it was decided, in order to avoid any chance of further accident, to burn it out. The reeds were very dry except round the occasional water pools and soon with the help of bundles of dried reeds an area of about 2 acres was burning fiercely. The tiger remained absolutely still all the while the reeds were burning, till the flames came right up to where he was lying, although the wind was carrying the smoke towards him and the heat even to us on the machan was almost insupportable. The tiger then suddenly broke back through a partial gap in the flames, scattered an elephant and some coolies who were advancing over the burnt out ground, and took refuge in a still smouldering but only partially burnt clump of reeds about 50 yds. further back. All this while, he was screened from the view of the machan by the flames and the smoke. The 5 elephants were then brought up in a close circle behind this clump and more burning reeds were thrown into it. At the last moment when it seemed that nothing would move the tiger, he made a sudden fierce rush across the narrow avenue that had been cleared opposite the machans at a distance from us of about 70 or 80 yds.

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[1] Curious semi-military ascetics peculiar to this part of Rajputana.

My wife had the first shot at it, and the Superintendent and I both fired, but although we thought the tiger had been hit by the first shot, we could not be certain of this. We then stopped the beat and the Superintendent and I, each on an elephant and keeping about 100 yds. apart went down the channel for some 200 or 300 yds. to get to the next open ground and had the reeds set fire to again. The heat where we were standing on our elephants was intense as the wind was blowing the smoke and the flames down on to us with the result that our elephants were most restive. Apparently the tiger, after coming down the channel towards us for some distance, broke back at an angle of 45° and showed itself for a brief moment in an open space, before diving into the only remaining unburned patch of reeds that was near. It was then clear that it had been hit, as he was moving rather slowly. Neither the Superintendent nor I had a chance of a shot, as we were facing in the wrong direction, but the shikari who was sitting on the elephant behind the Superintendent, had a snapshot which missed, as the elephant was swerving violently. We followed up the tiger taking up positions on opposite sides of the reeds and had them set fire to. Eventually when all but a small portion had been burned up, we moved in towards this, and the Superintendent coming upon the tiger lying with his head in a pool of water and obviously very sick, finished him off with 2 shots at close range. The shot which had first wounded the tiger had hit him in the breast rather low down and passed in and out between the ribs without breaking a bone.

On inspection the tiger proved to be a female, only 8 ft. 7 in. in size, but she had caused more trouble than any half a dozen ordinary tigers. For she kept us hard at work from 1 to 6 p.m. in the heat of a hot-weather day, severely injured one beater, frightened all the elephants and was only dislodged after several acres of reeds had been burned. I had always understood that wild animals dreaded fire, yet this tigress even when she was unwounded, lay quiet till the flames came right up to her, and broke back through the smouldering reeds rather than come out in front of the machans, which obviously she must have seen, as they were very low, and babul trees offer little cover. No other tiger was seen during the beat; although the whole area in which tigers could have lain hidden was gone over; so there is little doubt that this one tigress was responsible for all five kills the previous night, and was the same beast which had mauled several of the villagers, and destroyed numerous cattle.

THE RESIDENCY,
JAIPUR, RAJPUTANA. A. C. LOTHIAN.
*February* 14, 1934.

## III.—DO FOXES OCCUR IN BURMA?

There is some mystery about the occurrence of the Fox in Burma.

The fox is of course known to the people of Burma—the 'earth-dog'—they call it—but during ten years I have spent in the country I have only seen a fox on one occasion. It was at Bhamo in 1925, when I was occupying one of the old officers' houses in the Cantonments, that one day I saw a Kachin approaching my house leading a fox on a chain!

I called him up into my verandah, and then examined the fox which was a full grown young one in excellent condition and as tame and as confidential as a dog. Two airedales I had at the time were present, and examined the fox with interest. The fox showed no fear of them at all.

It was a typical fox of darkish colouration not reddish and with a good coat and 'brush'. It was of ordinary fox size, and quite typical. At that time I was not aware of the rarity of such an animal in Burma or I would have taken possession of it. The Kachin wanted Rs. 60 for it. He at any rate was in no doubt about its rarity.

He had an extraordinary story to tell as to how he had caught it. He said a fox and two cubs attacked one of the village pigs and killed it, and that he killed the fox with a stick and caught this cub which he had since brought up.

There is doubt about the occurrence of the fox in Burma and my letter is intended to open up the question with this record of one.

Personally I am of the opinion that there are no foxes in this country—although one would have thought the Shan States ideal for them—and that this one recorded came from across the border from Yunnam.

TAUNGGYI, S.S.S.
BURMA. T. R. LIVESEY.
*February* 14, 1934.

## IV.—A BISON SANATORIUM.

Namagundibetta (5,500 ft.) is a favourite haunt of bison on the Billigirirangans, but is chiefly remarkable for the fact that nearly every solitary bull shot in this hill has been found to be either injured or suffering from some disability. Out of ten solitaries shot there in recent years two were blind in one eye, three had been mauled by tiger, two were lame (one with a bullet wound and the other with foot and mouth disease), and another had a 6 in. piece of wooden stake imbedded in its chest and also a fly-blown ear. This bull had evidently impaled itself on a sharpened stake placed for deer (generally in a gap in a hedge bordering cultivation).

HONNAMETTI ESTATE,
ATTIKAN P.O., *Via* MYSORE, R. C. MORRIS.
S. INDIA.
*March* 22, 1934.

## V.—'WHITE BISON'.

With reference to Dunbar Brander's comments on the colour of 'white' bison, while agreeing with him that the term 'white' is strictly a misnomer I consider it is no more so than in the case of the White Rhino of Africa, and as a distinctive term I do not think it can be bettered. Many similar cases exist of animal species being distinguished in works on Natural History by a definite colour term whereas they are not of the actual colour applied to them. If Mr. Dunbar Brander can say that the appearance of one or more of his light coloured bison among a herd of the normal type, even when seen from a considerable distance, is *startling* in its light shade, there is a possibility that we are both referring to a similar type. I may add that Mr. C. C. Wilson, Conservator of Forests, Madras, recently had occasion to visit the South Coimbatore 'white' bison area. He went there, as I did originally, somewhat sceptical as to the existence of bison of the type that had been described, and he describes the specimen he saw, among normal herds, as quite remarkable.

I cannot do better than quote from his letter to me on the subject:—"Dunbar Brander is wide off the mark on this occasion. I have seen very many herds of bison all over South India, in Malabar, Coimbatore, Vellore, Madura, Nilgiris etc., and I have seen very many light coloured individuals before, but never anything so unexpectedly 'white' as these are. In my opinion "white" is the most accurate description of these bison that we can get, and can leave no doubt in anybody's mind as to what to look for. If we call them 'dormouse coloured' (which they are not) many people will be misled and will be reporting that they have seen them all over the country whenever the not uncommon light coloured bison is found in a herd."

Writing independently to a mutual friend Mr. Wilson describes the colour as a very light cream, and I agree with his description.

Honnametti Estate,
Attikan P.O., *Via* Mysore,
S. India. R. C. MORRIS.
*January* 18, 1934.

## VI.—GROWTH AND SHEDDING OF ANTLERS IN SAMBAR (*RUSA UNICOLOR*) AND CHEETAL (*AXIS AXIS*) IN SOUTH INDIA.

### Sambur.

| | |
|---|---|
| (A) Time of shedding antlers . | end March to mid-April. |
| (B) Period during which antlers are in velvet ... | end May to end October. |
| (C) Period when clean ... | end October to end March. |
| (D) Pairing season ... ... | middle to end November. |
| (E) Time when young are born | late May or early June. |

I find that the above periods are liable to variations of a fortnight or so in different years; for instance I have known sambur to be in hard horn by the middle of October, and in this case the pairing season would also start a fortnight earlier.

### Chital.

| | |
|---|---|
| (A) Time of shedding antlers ... | majority in August-September. |
| (B) Period during which antlers are in velvet ... | majority in September-February. |
| (C) Period when clean ... | majority in March-July. |
| (D) Pairing season ... | majority in March-May. |
| (E) Time when young are born | majority in September-November. |

As is well known, chital are mostly irregular in their antler shedding and rutting. Fawns may be seen at any time during the year, as also chital in velvet, but mature stags are fairly regular in their seasons except that the periods during which they shed their antlers, are in velvet, are clean, and are pairing, are longer in that these periods vary with individuals during those three months. I am now referring to mature animals only. There is no such regularity in the case of immature stags.

Honnametti Estate,
Attikan P.O., *Via* Mysore,
S. India. R. C. MORRIS.
*February* 4, 1934.

## VII.—GROWTH AND SHEDDING OF ANTLERS IN THE SWAMP DEER (*RUCERVUS DUVAUCELLI*) IN THE UNITED PROVINCES.

(1) The antlers begin to drop from about February 15th, but there are still a good many stags carrying horns during March. By about April 15th, practically all stags are hornless.

(2) The new horns begin to grow in a few cases at about the end of March, but the main period for velvet horn is May to August, continuing in a few cases into September.

(3) Horns begin to harden in September and most are quite clean by Ocober 15th.

(4) The chief rutting season is November to December, when the peculiar rutting call of the stag (something like a donkey braying with a droning under-note) is frequently to be heard.

(5) Most of the young are said to be born from May to July, but I have not very much personal experience on this point.

The closed season for gond in the United Provinces is from March 15th to October 14th.

Bahraich Division. F. W. CHAMPION,
*February* 9, 1934. I.F.S.
*Divisional Forest Officer.*

## VIII.—NOTES ON THE SWAMP DEER (*RUCERVUS DUVAUCELLI*) IN ASSAM.

(1) *Assamese Name.*—Male: Batina-Sakal Jati. Female: Belingi.

(2) *Time of shedding of antlers.*—February to March.

(3) *Time when antlers are in velvet.*—New antlers begin to appear in April to May. The antlers remain in velvet till the end of July; and the dry skin falls off during August to September.

(4) *Period when antlers are clean.*—August to September to February to March.

(5) *Pairing season.*—April to May, when the *male is practically without antlers.*

(6) *Time when young are born.*—This varies with the age of the mother. In the case of females that are not past their prime the young may be delivered in December to January; while in the case of older females the young may be delayed in their appearance till as late as the end of February.

(7) *Habit.*—Prefers high land surrounded by water all round. Does not care much for leaves of plants. Prefers grasses and reeds; and stays where these abound. Feeds mostly in the early hours of the morning and at evening time. Also loves to feed on rice cultivation soon after nightfall. It is believed that the animal takes a short rest after midnight.

(8) *Habitat.*—Exists in Goalpara, Kamrup, Nowgong, Sibanger and Danang Districts of Assam.
*Common Hindustani name.*—Barasingha.

NORTH KAMRUP,
ASSAM.
*March* 7, 1934.

C. A. R. BHADIAN, I.F.S.,
*Asst. Conservator of Forests*
*in charge North Kamrup Sanctuary.*

## IX.—CLICKING SOUNDS MADE BY MUNTJAC.

I have often seen mentioned, both in the *Journal* and elsewhere, that the Barking Deer makes a peculiar clicking sound. I have kept a deer for nearly three years and it is very tame. It frequently makes such a noise, and does it by putting its tongue out against its big canine teeth, first on one side, then on the other. It invariably does this when it sees me eating something, such as toast, of which it is fond. Whether this is the sound others have heard I do not know, but it answers the description and is certainly made with the tongue.

NOWROJ GARDENS, CHETPUT,
MADRAS.
*February* 24, 1934.

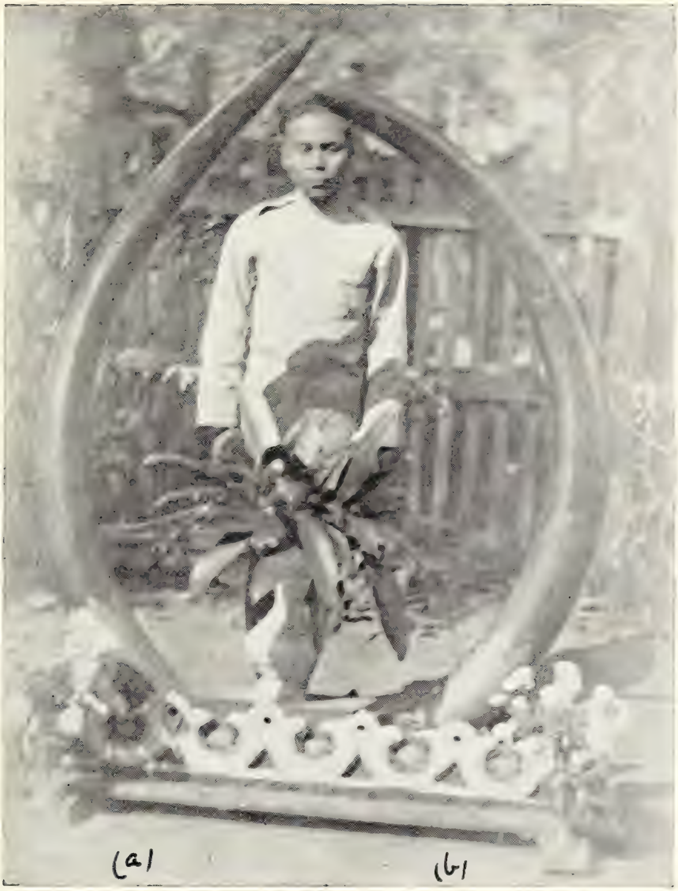
S. SUNDARA RAJ.

## X.—A LARGE PAIR OF ELEPHANT'S (*ELEPHAS MAXIMUS*) TUSKS FROM BURMA.

(*With a plate*).

I send herewith two photographs of a remarkable pair of elephant tusks which I saw recently at Lonhkin, in the house of Sinwa Nawng, Duwa of Kansi in the Kachin Hill Tracts of this district. These tusks are said to have been obtained from an elephant which was found dead about some eight years ago near Kansi village. This village is on the Uyu, a tributary of the Chindwin in the western part of this district. One photograph depicts a 5 ft. 6 in. Kachin standing between the tusks.

(2) The tusk (a) on the left-hand side of the photograph is 79½ in. long, and (b) on the right-hand side measures 77½ in. The girth of (a) near its base is 17 in. and that of (b) is 17¼ in. and at 5 in. from the tip, the girth of (b) is 10¼ in. These tusks are slightly larger than a very fine pair shot by Mr. H. E. Flint, O.B.E., in the Ruby Mines some years ago (which he has in Myitkyina and of which one is 79 in. and the other 69 in.). The Kansi tusks are extremely dark in colour. I did not get an opportunity to weigh them.



(a) 79½ in. length, 17 in. cir. near base.
(b) 77½ in. length, 17¼ in. cir. near base.
girth of (b) 5 in. from tip was 10¼ in.
The man is 5 ft. 6 in.

(3) I hope that the photographs will be sufficiently clear for reproduction, as though not a record they must be among the biggest obtained in Burma.

MYITKYINA,
UPPER BURMA.
*February* 20, 1934.

J. K. STANFORD,
*Deputy Commissioner.*

[In Rowland Ward's Records of Big Game, 9th Ed. (1928) the largest tusks obtained in Burma (owner's measurements) are 10ft. 6 in. in length and owned by Mr. H. Shaw Dunn. The longest measured in the Rowland Ward Studio taped 7 ft. 3⅜ in. in length, 17½ in. in circumference and weighed 102 lbs.—EDS.].

## XI.—STATISTICAL RECORD OF GROWTH IN THE INDIAN ELEPHANT (*E. MAXIMUS*).

The following notes may prove of interest. They have been compiled from a Register of Working Indian Elephants (1,507) and Calves (365) born in the service of a Firm extracting Teak in Burma.

1. No one has any reliable information regarding 'milk tusks' and none of our employees has seen them.

2. *Parentage and Sex.*—(*a*) A tusker calf shows its tusks from the age of 2 years to 5 years.

(*b*) Cases of calves with double tusks shedding one and so becoming 'tehs' are now authenticated.

(*c*) Tuskless male calves (Haings) are known to have tuskers as fathers. Tuskless males, as fathers, have reproduced double tusker calves.

*Musth.*—Reports by eyewitnesses prove that 'musth' in males was not present in the majority of cases of coition, and that the female has a periodical period of heat, which cannot usually be detected by the human being. A few cases have been recorded of females discharging from the musth gland, when apparently not on heat.

A tusker calf came on musth in his 15th year.

*Reproduction.*—A female calf, 15 years old, has produced her first calf. She must have been covered when just over 13 years old.

*Height Increment.*—Calves measured within three days of birth averaged 3 ft. 0 in. in height. 109 male and 111 female calves measured produced the following results in heights:—

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| In 1st | year | 6 | males | averaged | 3′0″ | 8 | females | averaged | 3′0″ |
| 2nd | ,, | 8 | ,, | ,, | 4′2″ | 5 | ,, | ,, | 3′11″ |
| 3rd | ,, | 7 | ,, | ,, | 4′5″ | ... | ,, | ,, | ... |
| 4th | ,, | 4 | ,, | ,, | 4′10″ | 3 | ,, | ,, | 4′6″ |
| 5th | ,, | 4 | ,, | ,, | 5′6″ | 3 | ,, | ,, | 5′1″ |
| 6th | ,, | 9 | ,, | ,, | 5 8″ | 10 | ,, | ,, | 5′5″ |
| 7th | ,, | 11 | ,, | ,, | 5′10″ | 12 | ,, | ,, | 5′7″ |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| In 8th | year | 8 | males | averaged | 5′11″ | 13 | females | averaged | 5′9″ |
| 9th | ,, | 9 | ,, | ,, | 6′1″ | 4 | ,, | ,, | 5′11″ |
| 10th | ,, | 7 | ,, | ,, | 6′5″ | 4 | ,, | ,, | 5′10″ |
| 11th | ,, | 6 | ,, | ,, | 6′9″ | 6 | ,, | ,, | 6′0″ |
| 12th | ,, | 6 | ,, | ,, | 6′10″ | 8 | ,, | ,, | 6′4″ |
| 13th | ,, | 7 | ,, | ,, | 6′11″ | 5 | ,, | ,, | 6′6″ |
| 14th | ,, | 6 | ,, | ,, | 7′2″ | 4 | ,, | ,, | 6′5″ |
| 15th | ,, | 4 | ,, | ,, | 6′11″ | 5 | ,, | ,, | 6′7″ |
| 16th | ,, | 2 | ,, | ,, | 6′11″ | ... | | | ... |
| 17th | ,, | 1 | ,, | ,, | 7′5″ | 3 | ,, | ,, | 6′6″ |
| 18th | ,, | 1 | ,, | ,, | 7′6″ | 3 | ,, | ,, | 6′7″ |
| 19th | ,, | 1 | ,, | ,, | 7′8″ | 4 | ,, | ,, | 6′8″ |
| 20th | ,, | 1 | ,, | ,, | 7′5″ | 1 | ,, | ,, | 7′6″ |
| 21st | ,, | 4 | ,, | ,, | 7′4″ | 1 | ,, | ,, | 6′8″ |
| 22nd | ,, | 1 | ,, | ,, | 7′3″ | ... | | | ... |
| 23rd | ,, | 2 | ,, | ,, | 7′5″ | 1 | ,, | ,, | 6′7″ |
| 24th | ,, | ... | | | ... | 1 | ,, | ,, | 6′8″ |
| 25th | ,, | 1 | ,, | ,, | 7′10″ | 1 | ,, | ,, | 7′0″ |
| 26th | ,, | 1 | ,, | ,, | 7′10″ | ... | | | ... |

An exceptional Tusker calf, not included in the above, measured 8 ft. 1 in. in his 19th year.

We do not consider these statistics perfectly accurate, for the margin of error during measurements has to be considered. Also far greater numbers of calf measurements are needed. As statistics progress, however, this margin of error will decrease.

Steel Brothers & Co., Ltd.,
Rangoon. GORDON HUNDLEY.
*February* 26, 1934.

## XII.—ON THE OCCURRENCE OF THE WHITE-COLLARED KING-FISHER [*SAUROPATIS CHLORIS* (BODD).] IN THE DISTRICT OF 24-PERGANAS WITH A NOTE ON JUVENILE COLORATION.

The form *chloris* of the species *Sauropatis chloris* (Bodd.) has its range, according to Mr. Stuart Baker's record in *F.B.I.* (Birds), 2nd ed., vol. iv, 275, limited to the 'coasts of the North-Eastern Districts of Bengal; once Cachar in Assam; Burmese Coastal Districts, Siam, Malay States, Borneo, Java, Sumatra, Annam'. No mention is made of the Sunderbans, where Blyth found and collected his specimens (*Cat. B. Mus.* A.S.B., 48), and Blanford noted the occurrence of the bird as being as common throughout the eastern coast of the Bay of Bengal (*F.B.I.*, old ed., vol. iii, 136). It is difficult to see if the 'North-Eastern Districts of Bengal' may, by implication, have any reference at all to the Sunderbans. The Indian Museum holds a goodly number of skins (Nos. B517-21 and B529) of this form all collected from the Sunderbans. So far as Lower Bengal is concerned, not only do the Sunderbans afford the birds a congenial habitat but the inland parts as well, in many cases considerably away from the Sunderbans, harbour the race in not negligible numbers. Their occurrence in the immediate vicinity of Calcutta was noted by Cunningham who wrote (1903) 'another characteristically Sunderban species, *Sauropatis chloris*, may sometimes be seen about the ponds in the Botanic Garden'. Curiously enough there appears to be no other record of such occurrence. In my rambles in the District of 24-Perganas I have found them not uncommon in its north-eastern parts, and affecting the low-lying alluvial tracts known as *Churr* lands on the banks of the river Ichamati, a little beyond and to the east of Basirhat town (about 40 miles North-East of Calcutta). Chiefly arboreal as they are, they affect not only the date trees and shrubs growing on or near swamps and *Churr* lands but also orchards of neighbouring villages and even roadside trees. Fairly bold and noisy, they keep on the trail of fisher people when dragging nets and incessantly utter their shrill calls. They are easily captured with fish bait, fish being their tempting food. However local and circumscribed their habitat the birds are found in this area throughout the year. They nest in tree-holes, such nests being often found in orchards or fruit gardens adjoining the villagers' huts. Of the specimens obtained by me two young birds (fledglings, just out of nest) deserve mention. Their juvenile coloration being thus noted in my diary:

July 26, 1931. Two young *S. chloris* (Bodd.) out of nest, sitting on two different branches of a jack tree beside the road beyond Basirhat town to Itinda. Being fed on insects by both parents. Coronal plumes erectile,—a feature specially noticeable whenever agitated, with the tail moving and shaking.

Measurements:—

Reg. No. T1931. 5. Wing 99 mm.; tail 55 mm.; tarsus 18 mm.; culmen 36 mm.; gape 45 mm.

Reg. No. T1931. 6. Wing 100 mm.; tail 50 mm.; tarsus 17 mm.; culmen 38 mm.; gape 46 mm.

Coloration more pronounced: head and crown with more green; neck-collar white mixed with buff and tipped greenish black; barrings on breast brownish black; buff on flanks and vent prominent.

*Description*:—Forehead, crown and nape dull brownish-green contrasting with the bluish-green of the upper back; sides of head brighter green, feathers of forehead edged with rufous; lores black; a rufous-white patch above the lores extending over the eye; ear-coverts black, which is produced as a band behind the nape, the latter having an ill-defined patch of white tipped with brownish-green; below the black band is a broad collar of reddish-white tipped with bluish-green; lower back, rump and upper tail-coverts bright blue, rather inclined to purplish; scapulars and wing-coverts bluish-green tipped with rufous. Quills black on inner and greenish-blue on outer webs; two central tail feathers blue as lower back, the others blue on outer web and portion of inner web, the rest of the latter dark brown or black. Undersurface of quills and tail feathers glossy grey. Lower parts white; feathers of breast and flanks fulvous and edged with dusky, the latter appearing as crescentic bars of brown; abdomen, vent and undertail-coverts white, faintly tinged with buff; axillaries and underwing-coverts white, edged with silver grey, a few feathers tipped with greenish-blue.

Iris light brown; upper mandible and the edges of the lower dull black, with white and hooked extreme tips; basal two-thirds of the lower mandible light flesh-colour; inside of mouth red; legs plumbeous, inner surface of toes, and tarsus pale fleshy; claws blackish or dark horn.

CALCUTTA.
*February* 13, 1934.

S. C. LAW, M.A., Ph.D.,
F.Z.S., M.B.O.U.

## XIII.—NESTING HABITS OF THE BLUE-ROCK PIGEON (*COLUMBIA LIVIA*).

Will you, please, let me know if the following incident is unusual? My engineer, once saw two Blue-Rock pigeons drinking from the exhaust water of a steam engine—temperature of the water being 140° F.! I have found these birds living happily in very odd places: in the engine room where two coupled vertical triple expansion steam engines (developing a total of two thousand horsepower) are working day and night; over a battery of steam boilers where valves are hissing continuously—even the blowing off of live steam under a pressure of 200 lbs. does not disturb their equanimity. They not only reside in these places but even breed there!

AHMEDABAD.
*December* 18, 1933.

H. N. ACHARYA.

[The Blue-Rock Pigeon, which is almost semi-domesticated in many parts of India, has adapted itself to the varied conditions of life which its association with man imposes. It is not uncommon to see the nests of these birds in the engine rooms of mills, or in railway stations, where, in the roofing above the track, the nests and their occupants are exposed to heat, steam and smoke. Conditions which appear to cause them little inconvenience.—EDS.].

## XIV.—OCCURRENCE OF THE MANDARIN DUCK [*AIX GALERICULATA* (LINN.)] IN THE MANIPUR STATE.

On the 3rd March, 1934, two Mandarin drakes and two Mandarin ducks were shot in Manipur State. As the bird has been recorded very rarely in India, I send a description of the shooting in case it may be of interest. Capt. W. L. Neal, I.M.S., and I were shooting down the Mayangkhang Valley at a height of about 3,500 ft. The valley is narrow varying from about 200 yds. to half a mile in width with hills on either side rising to 5,000 ft. or more. The Senapati stream runs through the valley joining the Barak river about 6 miles away. It is quite a small stream varying from about 12 to 25 ft. in width, with a stony bottom, and at this time of year about ankle-deep in most places. There are occasional pools and here and there old beds of the river with water and high grass in them.

Capt. Neal who was walking along the bed of the stream fired at 4 or 5 duck which rose from it. Two birds fell; but they were rather far away, and, although we searched for some time, we could find no trace of them. At this place the stream is right up against the hillside which was covered with thick grass and some trees. It was a shady spot and the water was perhaps a foot deep. In the shade the visibility was poor and we did not recognise that the birds were any unusual kind of duck. Common teal have been shot in that valley before.

About one mile further on one pair, a drake and a duck rose out of an old bed of the stream from thick high grass in front of me. I had just shot a bamboo partridge and was not loaded when the duck rose. It flew back and Capt. Neal shot it. The drake rose a moment later and flew back. I failed to bring it down. We still did not know what the birds were. The drake appeared to settle about a mile away up stream.

Later in the day Capt. Neal left and Mr. C. F. Jeffery, State Engineer, joined me. We returned along the stream and this time I shot the drake, which Mr. Jeffery identified. There seems to be no possible doubt about the identification. I have sent you the skin of one drake and one duck to verify.

When we went to the place where Capt. Neal had first fired, Mr. Jeffery's Labrador bitch found both the wounded birds in the long grass on the hillside. We had previously decided that, if they could fly, we should not shoot; but both had been hard hit and we could not leave them.

IMPHAL,
MANIPUR STATE, C. GIMSON.
ASSAM.
*March* 28, 1934.

[The birds sent in for identification were Mandarin Ducks (*A. galericulata*). According to Stuart Baker, *New Fauna*, the Mandarin has so far only been obtained at Lakhimpur, Assam, by Stevens. Six birds were once seen by the author.—EDS.].

## XV.—MIGRATION AND DECREASE OF SNIPE IN THE ANDAMANS.

I was very pleased to read in vol. xxxvi, No. 4, *B.N.H.S. Journal*, Major A. Bayley-de-Castro's reply to my letter on early snipe in the Andamans. I too have found odd birds very late in the year but I seldom shoot them as I find them usually quite unfit to eat. I consider that it is quite possible that some snipe do permanently remain in the Andamans.

Major Bayley-de-Castro's letter has also touched on another matter in which I am greatly interested—the migration of snipe. Unless 1932 and 1933 were exceptionally bad years for migratory snipe the number of birds which visit the Andamans is steadily decreasing. Recently I was speaking to a retired Indian Officer of the Military Police Battalion who has spent more than 30 years in the Andamans and he assured me that this was the case. This year out of 23 days I had 7 days shooting with an officer who is a good average shot. On no occasion, if we had shot brilliantly, could we have killed 25 couple of snipe and our best bag was actually 18 couple. When we did find birds in any quantity, and that was chiefly on the hillsides, they were extremely wild and got up in wisps. There was a minor cyclone in the middle of November and on November 19th, after the wind had dropped I went out alone and picked up 16½ couple of snipe which was my best bag this season. In the Settlement Mess Game book there is an entry to the effect that one gun shooting alone in 1928 killed 1,000 snipe before Christmas. Since then the book, although it has not been too carefully kept, clearly shows that there have been a series of very lean years. Last year I personally accounted for 105½ couple of snipe and this year for 118½ couple. I have one more year to serve in the Andamans and I hope that it will produce a really good snipe season but I am afraid that the days of big bags are past, although the birds are not harried by overshooting, another officer and myself being the only two regular guns.

Port Blair,
Andaman Islands.
*January* 31, 1934.

J. MILES STAPYLTON, I.C.S.,
*Deputy Commissioner.*
Andaman and Nicobar Islands.

## XVI.—OBSERVATION ON THE NEST OF THE DABCHICK [*PODICEPS RUFICOLLIS* VROEG]

I am indebted for much help in recording these observations to Master Kannan, the young son of Dr. M. Ramaswami Nayudu, Ph.D. (Liverpool), who kept careful watch over the nest and bird. His first experiment was to hatch one of the dabchick's eggs under a hen, thinking he would get a young one to study at his convenience, but the hen, wondering what sort of strange creature had got into her nest, ate it up directly it emerged from the egg!

The nest was built on the top of a bush near the bank of a pond in Madras City. It was not more than two inches above the water level and took the form of a shallow saucer-like hollow 12.25 cm. in diameter, consisting of a soft padding of weeds, chiefly *Elodia*. Two eggs were in the nest when I saw it. They were whitish when laid, but by that time had become dark brown with mud and water. The two eggs measured 36 and 36.5 mm. in length and 25 mm. in breadth. Four eggs were laid, according to Kannan's diary, as follows—one each on the 25th, 27th, 29th and 30th December.

On Saturday, 3rd March, at about 4 p.m. on Malad-Merve beach near Bombay, at 2-20 p.m. two chicks were brought to me and I kept them for a few days, putting them into a box at night with a lamp and in the day time into an improvised nest of weeds in a large vessel of water. From the moment of birth they were able to swim and dive. Feeding was difficult but they learnt to take minute scraps of fish from a pair of tweezers. They were coloured characteristically with black and buffy stripes, but in addition had a beautiful coral red beak. This red colour quite disappeared by the third day. After keeping them for three days one died, and I returned the other to the nest. In the meantime the third egg hatched and, four days after the first, the fourth and last egg hatched. After that the hen abandoned the old nest and took the young ones to the weeds in an inaccessible part of the pond.

The bird covered her eggs very carefully every time she left the nest. At the slightest alarm she would hastily throw some weed over the eggs and dive into the water, to emerge some distance from the nest. When all was quiet she would return by a circuitous route, uncover the eggs and sit again. The nest was soaking wet.

At the time of writing—February 21st—there seemed to be only one young one left with the mother bird, which she was intent on teaching to fend for itself. At least it got a sharp peck if it came too near.

Stuart Baker gives January and December and again in June as the period of nidification in Ceylon, and May and June as the usual time in South India. It appears from this however that nesting goes on at the same time in Madras as in Ceylon.

NOWROJ GARDENS,
CHETPUT,
MADRAS.
*February* 24, 1934.

P. S. SUNDARA RAJ,
(Mrs.)

## XVII.—A LARGE MUGGER (*CROCODILUS PALUSTRIS* LESSON) FROM BIKANER.

The Heir-Apparent of Bikaner has just shot a very fine mugger proper, not gharial, which measured 11 ft. 0 in. exactly from nose to tip of tail. I give below some measurements:

| | | ft. | in. |
|---|---|---|---|
| Skull just above the eyes | ... | 3 | 2½ |
| Girth of neck | ... | 3 | 11 |
| Girth of largest portion of body | ... | 4 | 6 |

As this appears to be a very fine specimen indeed, the Prince would be grateful by your kindly letting me know how it compares with some of the largest muggers shot in India and what the record length is.

BIKANER. THE SECRETARY TO THE
*February* 10, 1934. HEIR-APPARENT OF BIKANER.

[In the second edition of the Fauna British India (Reptilia) the Mugger (*C. palustris*) is said to attain a total length of 4 metres (approximately 13 ft. 2 in.). The Estuary Crocodile (*C. porosus*) is said to attain a length of 33 ft. but individuals exceeding 20 ft. are rare. We should be glad to receive from readers of the *Journal*, measurements of large mugger which they may have occasion to take.—EDS.].

## XVIII.—NOTE ON THE LOGGERHEAD TURTLE [*CARETTA C. OLIVACEA* (ESCHSCHOLTZ)] DEPOSITING ITS EGGS.

(*With a plate*).

On Saturday, 3rd March, at about 4 p.m. on Malad-Merve beach, I was idly watching the sea when a curious upheaval, which subsequently resolved itself into something which looked like the Loch Ness monster, showed up near the edge of the water, and proceeded to steadily move towards the shore. I walked down to have a look and saw a large turtle emerge. The turtle crawled laboriously from the edge of the sea up to about 6 ft. above the high water mark at the foot of the sand dunes. Her progress was slow and she frequently stopped and held her head in the air swallowing vigorously. On arrival at the foot of the sand dunes, she immediately set to work to dig a hole with powerful alternate strokes from her hind flippers, holding herself rigidly in position by her fore flippers. She gradually deepened the hole until she had got quite a respectable excavation about a foot wide and 18 or 19 inches deep. Towards the last, it was curious to see the tremendous efforts she made to get her back flippers down to the maximum extent possible into the hole in order to dig it as deep as possible.

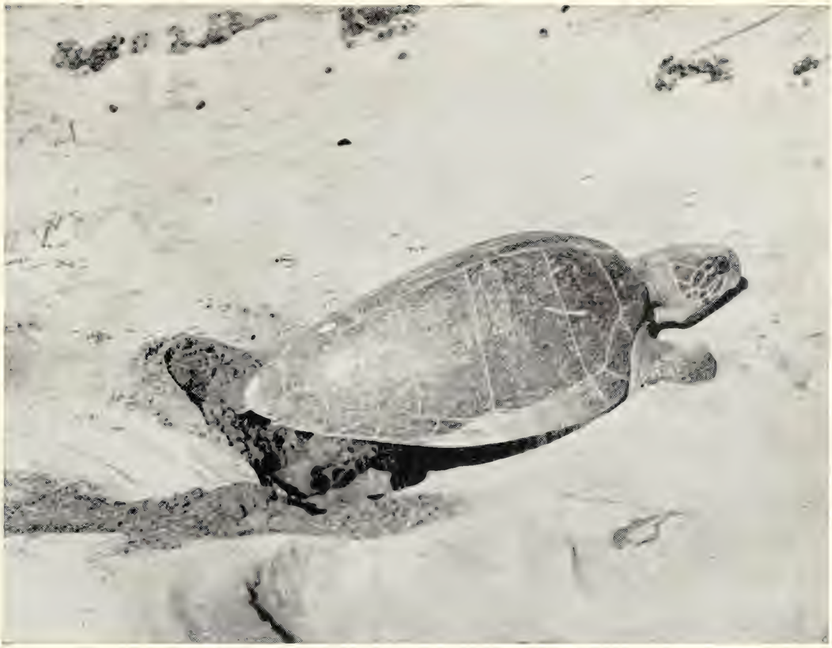
The two photographs show her clearly

(*a*) at the point where she is flipping out the sand with her body in a horizontal position,

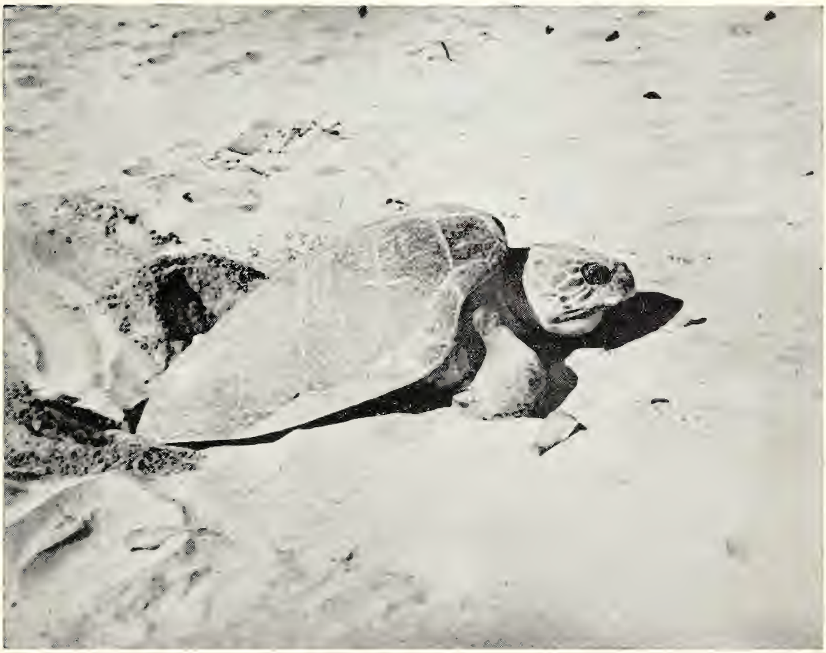
(*b*) straining to get her back flippers down into the hole to the maximum extent.

By this time, quite a large crowd of villagers and others had gathered around her. She took not the slightest notice of anybody, but continued to dig. She then settled down flat on the top of the hole. One of the villagers started digging a deeper hole behind the egg-chamber and tunnelled through to it. As her eggs dropped, they rolled through the tunnel and he removed them. In all she laid 122 eggs about the size of ping-pong balls, with a tough skin of a whitish-blue hue.

The whole process of laying took about 12 minutes. The villager then quickly covered up his hole so as not to disturb her,



1. Loggerhead Turtle [*Caretta c. olivacea* (Eschscholtz)] commencing to scoop a hole in the sand before depositing eggs.



2. Loggerhead Turtle (*C. c. olivacea*) deepening the hole in the sand to its maximum depth.

*Photos by J. B. Greaves.*

and she, oblivious of the fact that all her eggs had gone, proceeded to rotate round and round, smoothing the sand, as she thought, over her eggs.

When the hole was quite filled up, she started off back to the sea with the same laborious slow process, with frequent pauses and gulpings for breath.

As soon as she entered the water, her speed increased, and it was as much as one could do to keep pace with her wading quite fast. She went straight out through quite heavy surf until she was no longer visible.

The whole proceeding took about two hours from when she emerged from the sea to when she returned to it.

Forbes Street,
Bombay. J. B. GREAVES.
*March* 15, 1934.

## XIX.—THE LARVA OF THE LOBSTER MOTH (*STAUROPUS DENTILINEA* HAMPSON).

(*With a plate*).

Of all known larvae, surely that of *Stauropus* or the Lobster Moth is the most bizarre. The moth is more commonly come across than the larva but neither are common; the latter from its cryptic colouring and stance is most difficult to see even to the trained eye and because few collectors have had the good fortune to come across it, the following short note will be of interest.

*Stauropus fagi* Linn., the genotype is found throughout Europe and England and was considered a prize even in my young days. Five species have been described from within Indian limits of which three are confined to the Himalayas, one to the Nilgiris and a fifth to a much wider area extending from Assam to Burma, Ceylon and Java. The latter probably includes several distinct races. The larvae of the genotype, of *Stauropus alternus* and *sikkimensis* alone are known, that of *dentilinea* hitherto being unknown.

The latter closely resembles that of the genotype and of *S. alternus* in its colouring, there is however only a single subdorsal oblique stripe which is of pure dazzling white and confined to the 6th somite. Laterally two pale purplish white arches are found, one extending from the 4th to the 7th somite and the other confined to the 9th and 10th somites. The ground colouring is of a rich mahoghany tint with diffuse brighter ferruginous patches on the sides. There is also a dark brownish streak on each side of the head. Paired dorsal processes are found on the 4th to the 9th somites instead of on only the 6th to 8th, and there are also two unpaired processes on the terminal somite. The sides of the latter are expanded broadly and the preceding somite has three fleshy spines on each side. The legs show the same extraordinary development characteristic of the genotype (Fig. e) and are minutely spined throughout. Hampson states that the anal prolegs are absent but this is an error, as the two angular processes attached to the anal somite, are in reality extraordinarily developed prolegs, as in the case of the 2nd and 3rd pairs of true legs. In some specimens these are absent having been lost from autotomy or eaten off by other larvae, a not uncommon accident when several larvae are kept together in captivity. When at rest, the larva rests on its prolegs which are stretched out like a suspension bridge, the head and anterior somites being curved strongly over the dorsum of the insect so as to meet the expanded anal somite which is also held strongly curved forwards over the dorsum. The anal prolegs are held in close apposition except when the insect is moving or feeding when they diverge strongly, apparently to allow of the free passage of frass from the anal orifice situated just above them. During rest the tarsi are constantly flexed and extended, a peculiar action which strongly reminded the writer of the action of cilia in a vorticella. The purport of this action was not at all clear. When at rest also the true legs are held straight out in front very like a praying-mantis, the 2nd and 3rd pairs of tibiae being closely apposed to the femora. As a rule the larvae pose on the edge of a leaf and look for all the world like a piece of dried crumbled or curled leaf. It was interesting to note that dried broken leaf on the food plant was of exactly the same bright mahoghany colour, so that the detection of the larvae was extremely difficult. When moving, the head is held well back, flexed over the dorsum of the anterior segment except when actually feeding, and the terminal somite is invariably carried aloft. In spite of its remarkably cryptic appearance, this larva falls a frequent victim to parasitic flies and few specimens can be obtained which are not victims to these unwelcome insects. The figures shown were drawn from specimens obtained in Coimbatore during December and the type larva has been sent to the Society's collections.

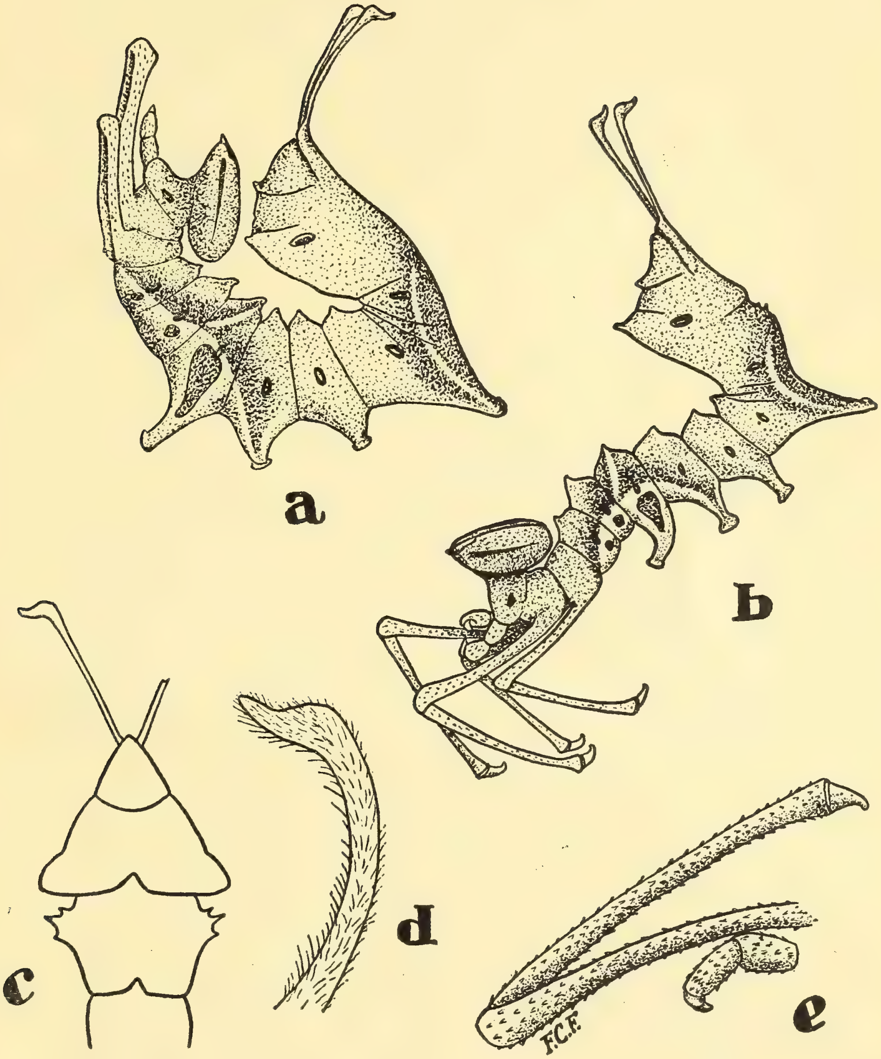
COIMBATORE. F. C. FRASER, I.M.S.,
*January* 6, 1934. *Lt.-Col.*

EXPLANATION OF FIGURES.

*a.* Side view of larva of *Stauropus dentilinea* Hamp. (The Lobster Moth) in defensive or resting attitude.
*b.* The same larva moving actively.
*c.* Terminal somites viewed from above.
*d.* Anal proleg greatly magnified.
*e.* First and second legs. (The third pair are rather shorter than the second.)

## XX.—THE FLEE-BEETLE *HALTICA CYANEA* WEBER FEEDING ON THE LEAVES OF THE WATER-CHESTNUT (*TRAPA BISPINOSA* ROXB.).

While botanising near Panvel on the 25th February this year I noticed large numbers of the Chrysomelid beetle *Haltica cyanea* feeding on the leaves of the Water-chestnut (*Trapa bispinosa*). The



Larva of *Stauropus dentilinea,* Hmps.
(For explanation of figures see end of note.)

beetles completely destroyed the floating leaves, particularly of the plants nearest the shore of the tank.

Maxwell-Lefroy (*Indian Insect Life*, p. 361) states that the larvae of this species feed on the common weed *Ammania rotundifolia* which comes up abundantly after the rains. This observation I am able to confirm but add that the adult is a common beetle met on most *Ammanias*, even the strong smelling *A. baccifera*, L.

Bombay Natural History Society,
Bombay.
*February* 27, 1934.

C. McCANN,
*Asst. Curator.*

## XXI.—OUTBREAK OF MILLIPEDES AT JALGAON.

Millipedes are known to be vegetable feeders and are always found in fields and gardens especially in wet places among plants and in decaying vegetable matter. Until the year 1932 at least in this part of India they were never reported to have done any damage to cultivated crops. In July of that year at Jalgaon Farm, East Khandesh, the young seedlings of *jowar*, *tur* and ground-nut were destroyed by these millepedes all of a sudden appearing in enormous numbers. The damage was considerable, so much so, that the jowar crop had to be resown. In the year 1933 exactly in the month of July on the same Farm the appearance of these millipedes was noticed, but the damage was not much in the *jowar* crop. The reason was that there was a break in the rains for about a fortnight and three repeated interculturings, which were necessary to enable the crop to hold out without rains, checked them, whereas last year the conditions were different on account of the wet season. However, in the Cotton Breeder's area the outbreak was very serious. The Cotton Breeder reported that the damage done to cotton plants in the pedigree culture (where every plant had its value) would have been enormous were it not for the severe campaign that was set up against these creatures. The enormity of the numbers can be judged from the fact that no less than two millions of these animals could be hand picked and destroyed from an area of two acres only within the course of four days. The amount of money spent for the collection was about 50 rupees besides the use of a tin of Kerosine oil for destroying them. These millipedes have been identified by Professor Silvestri of Portici, Italy, as a species of *Spirostreptus* allied to sp. *modestus*.

College of Agriculture,
Poona.
*January* 29, 1934.

V. G. DESHPANDE,
M.A.G., Ph.D

## XXII.—TERMITE COLLECTING IN SOUTH INDIA FOR FOOD.

It will be interesting to learn that 'white ants' have got an edible value. The queen ants were formerly used for medical purposes but now people use them both medically as well as for food. In Madura, Nagercoil and other places people make big collections of these insects during the rainy months when 'swarming' takes place.

There are two popular methods by which these termites are captured. In some places during the swarming season men dig moderately large pits by the side of the termite nests and fill them with water. Near these pits lighted torches are fixed. The insects attracted by the light crowd over the pits and eventually fall into them. The fallen insects are soon caught and filled in empty bags. This is the light mechanism.

In Madura the method is quite different. In these parts children seem to take more interest in termite collection than men. During rainy months they search for the termite holes and finding one, they blow hardly into it making a shrill sound. The winged termites disturbed by the sound, swarm out and in their attempt to fly they are easily captured in cloth-nets.

The wings and the legs of the termites so collected are removed and the rest roasted with a small quantity of salt and pepper added to it. The roasted white ants are widely used as a delicious article of food. In Nagercoil and such localities it is a common sight to see poor men and women sitting by the road-side and selling these roasted insects as they sell roasted ground-nuts or beans.

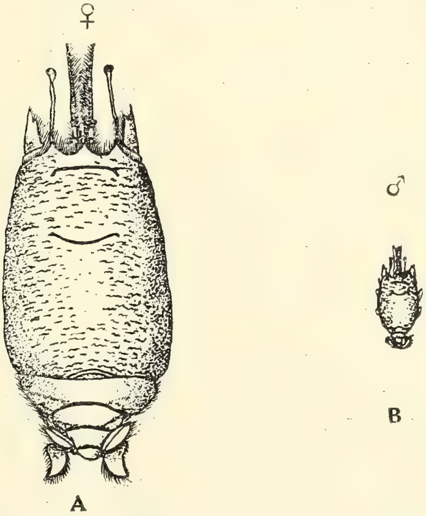
Government Museum,
Madras.
T. V. SUBRAHMANIAM, B.A.

*January* 28, 1934.

[We recall here a note on Red Ants as food (A. M. Long, vol. xiii, p. 356). The Murries of Bastar, the southernmost Native State in the Central Provinces use red ants as a regular article of food. Whole nests of these insects are taken, torn apart and shaken into a cloth. The occupants mature and immature are beaten into a pulpy mass with a stone and then parcelled into small packets for sale. You may eat the bolus raw after seasoning it with salt, turmeric and chillies or you may cook it with rice flour, chillies etc. into a thick paste. Regular consumption is said to give great power of resistance against fatigue and the sun's heat. The jungle people of Canara have the same liking for red ants as food and deal with them in much the same way as the Murries do. (Aitken, vol. iv, p. 153.) The squashed insect gives out an acrid smell and when many are being pounded up the 'fumes' which arise make the eyes smart. Aitken suggests that the sensation produced when eating them 'must be like a torch light procession going down the throat'. Apart from food value it is good to know that the acrid aroma of pulverised red ant is a substitute for *smelling salts.*' Tamil coolies in Ceylon use it (A. L. Butler, vol. x, p. 330). The modus operandi is to go to a teeming nest in a bush, seize it with both hands and rub ants and nest together violently between the palms, then take a few good penetrating sniffs of the ammonia-like fumes which arise from the crushed and bruised insects. This, we are told, will instantly relieve a severe cold in the head. The termites which form the subject of the above note are no connections of ants. As a family they are considered relatives of the Cockroaches. Cockroaches as an article of food also provide a long and interesting subject. Space does not permit us to discuss it here.—Eds.].

## XXIII.—A NOTE ON THE MALES OF *EMERITA (HIPPA) ASIATICA.*

No reference to the males of this species occurs in the works of any of the Carcinologists[1] who have dealt with it. The only explanation is that they either failed to notice it, or, which is more probable, their great disparity in size would have caused them to be mistaken for young ones.



A. Female of *Emerita* (*Hippa*) *asiatica*. B. Male.

The carapace of the adult females varies from 22 to 30 mm. in length with an average of 25 mm., while the largest male I have been able to secure at this place has a carapace length of only

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[1] Milne Edwards, 1837; Heller, 1868; Miers, 1879; Henderson, 1893; Nobili, 1903.

7.5 mm. The corresponding lengths for the two American species *E. emerita* and *E. analoga* are respectively 20 to 22 mm. (female), 14 mm. (male) and 22.4 mm. (female), 12 to 14 mm. (male). It is thus seen that though the adult females of the Asiatic species are decidedly larger than their American confreres, the males are only about half of those of the latter. There is, however, no positive evidence to show that they do not grow beyond this size; but the failure to secure larger ones, though collections were continued for more than two months amounting to a couple of hundred specimens, seems to show that such is the case.

A very interesting point about their habits that has been observed seems worth mentioning here. In the months of March and April the narrow zone of the low water mark was teeming with the young ones of this animal, so that one can collect several by simply scooping up a handful of sand. A collection made at this time shows a good number of males, which can be easily recognised by the presence of the genital papillae on the coxopodites of the last pair of thoracic legs. They varied from 4 to 6 mm. in the length of their carapace. No attempt was made to collect them in the next two months. In July, however, they had grown considerably and all of the large ones were females. This inexplicable absence of large sized males led to a more careful search and it was then discovered that adult females which had recently moulted and were therefore softbodied had each two or three, and sometimes more, young individuals on the ventral side between the posterior part of the thorax and the abdomen; the latter being normally pressed against the underside of the thorax. They do not seem to be attached to any part of the female; but are probably prevented by the thorax from being displaced.

On examination all of them were found to be males. In one or two cases a stray female was also noticed, but that seems to be only exceptional. The females carrying them had a mass of spermatophores in the groove between the sixth and seventh pair of thoracic legs. In *Emerita* also therefore, as in several other crabs, the union of sexes takes place soon after moulting. The spermatophores are simply deposited on the ventral surface of the female, the coxal papillae of the last legs probably aiding in the process.

The smallest of these males measured only 3.5 mm., that is only slightly bigger than the first post larval stage and possessed vestiges of the abdominal limbs which completely disappear later. The reproductive system on the other hand was well developed and often contained fully developed sperms. Most of the males secured from females varied between 3·5 and 6 mm. in length, larger ones being only found very rarely in association. In some of these specimens a part of the long string of spermatophores was actually seen protruding through the genital opening. There is therefore no doubt that these are fully mature individuals.

Though the habits of the two American species have been studied by several authors, nothing so far as I am aware, has been recorded about such an early association of sexes as obtains in the case of the present form.

The very early development and maturation of the sexual organs in young ones which have probably undergone only a single moult after the first post larval stage (as indicated by the size) is also a very interesting phenomenon in the Decapoda. It appears that sex differentiation takes place at a very early stage in the life of this form and the males, whenever possible, come into association with the females soon after leaving their free swimming existence.

In a few instances one or two of the smallest individuals were in the process of ecdysis which might indicate that in their case at any rate the association is not quite temporary.

In the allied form *Albunea*, one species of which, *A. symnista*, exists side by side with *Emerita* at Madras, adult males attain to about two-third of the size of females and are easily got at certain times of the year. It would seem therefore that the case of the latter is an instance of premature sexual maturity. Secondary sexual characters like greater size, differently shaped chelipeds, narrow abdomens and so on are frequent in male Decapods. Dimorphism of males, the two forms in some cases being 'alternating breeding and non-breeding phases in the life-history of the same individual' has also been noticed among some Crayfishes and crabs belonging to the subtribe *Oxyrhyncha*. But instances parallel to that of *Emerita* do not seem to be of common occurrence. The fate of these males, after the transference of the reproductive elements should therfore be of great interest and it is hoped that a systematic search to be made hereafter would yield definite information bearing on it.

MADRAS. M. KRISHNA MENON, M.A.

## XXIV.—OCCURRENCE OF *ISOËTES COROMANDELINA* L. IN THE BOMBAY PRESIDENCY.

In vol. xxxv, p. 471, I recorded the occurrence of a species of Isoëtes in the Presidency. I submitted the material for examination and report to Dr. H. Reimers of the Botanischen Garten und Botanischen Museum, Dahlem (Berlin). He writes: "There is only one species in East India, namely *Isoëtes coromandelina* L. Your plant is a large form of this species and agrees very well with *I. brachyglossa* Braun described in 1862 from the Nilgiris (Wight No. 309) but now considered as a mere form of *I. coromandelina*. The species is also represented in our herbarium from Madras and Terampur[1] (near Calcutta ?). In N. E. Pferffer's monograph of the Isoëtaceae (Annals of the Missouri Bot. Garden, vol. ix, 1922) the following species are recorded from 'Peninsula India' Wight Crypt. No. 4; 'Peninsula India' leg. Royle; Madras leg. Fyson 1913; Madras, near Seven Pagodas leg. Kashyan 1922.

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[1] This is obviously a mistake for 'Serampur' which is near Calcutta.

The type specimens of *I. coromandelina* were collected by König in the 'Coromandel'. The species was described by Linné fil. in 1781 (Suppl. Plantarum, p. 447). We have in Berlin specimens probably from the type collection in the Willdenow Herbarium.

Now I give a short description of the species.

Corm 3-lobed (in other species 2-lobed); leaves 16-20 cm. long, with very wide membraneous wings at base, extending above the sporangium level; stomata numerous in upper region, lacking in basal portion of leaves; peripheral strands 'sklerenchym-strang' present, 4 very strongly developed with several weaker accessory; ligule conspicuous, *very wide and short*, often appearing truncate in older leaves but pointed in young leaves (after Braun *I. coromandelina* has a pointed ligule, *I. brachyglossa* a truncate one); sporangium large 12 × 9 mm.; velum none; megaspores white when dry, grey when moist, 480-540 $\mu$ in diameter, *marked with numerous large tubercles*, closely arranged and occasionally extended into very short rounded ridges; microspores red-brown or paler, 26-33 $\mu$ smooth.''

My thanks are due to Dr. Reimers for the trouble he has taken over my material.

BOMBAY NATURAL HISTORY SOCIETY,
BOMBAY.
*January 7, 1934.*

C. McCANN,
F.L.S.,
*Asst. Curator.*

# WILD ANIMALS OF THE INDIAN EMPIRE

## AND THE

# PROBLEM OF THEIR PRESERVATION.

The Plates for this serial were not received in time for publication. Part III which deals with the Carnivora will appear in the next issue of the Journal.

## PROCEEDINGS OF THE ANNUAL MEETING OF THE BOMBAY NATURAL HISTORY SOCIETY.

The Annual General Meeting of the Society was held at the Prince of Wales' Museum on Monday the 19th March, 1934, at 6 p.m. Sir Reginald Spence was in the Chair.

### AGENDA.

1. Reading of the Annual Report of the Committee.
2. Presentation of the Balance Sheet and Statement of Accounts for the past year.
3. Election of the Committee.
4. Such other business as may be properly brought before the meeting.

Mr. P. M. D. Sanderson announced the election of 61 members. These included the Governors of the Central Provinces and of the United Provinces. His Excellency the Governor of Bombay Lord Brabourne has honoured the Society in becoming its President.

In presenting the Report for the year 1933, Mr. Sanderson said that there were 3 important events during the year: one was the completion of the thirty-sixth volume of the *Journal;* the second the Fiftieth Anniversary of the founding of the Society; and the third the decision of the Trustees of the Prince of Wales' Museum to build an extension to the existing building to which the Natural History Section would be transferred and in which it would have the much needed additional space.

Mr. Sanderson then reviewed the main contribution to the *Journal,* to the various activities of the Society during the year as embodied in the Report which is printed in this number.

Mr. A. Forrington, Honorary Treasurer presented the balance sheet and statement of accounts for the year 1933 which were duly adopted. The Balance Sheet and Statement of Accounts are issued with the Report.

The following gentlemen were elected to serve on the Society's Executive and Advisory Committees during the year 1934:—

## BOMBAY NATURAL HISTORY SOCIETY.

### OFFICE BEARERS—1934.

*Patrons.*—His Excellency The Viceroy of India; H. R. H. The Prince of Wales, K.G.

*Vice-Patrons.*—H. H. The Maharao of Kutch, G.C.S.I., G.C.I.E.; H. H. The Maharaja of Jodhpur, K.C.S.I., K.C.V.O.; H. H. The Maharaja of Rewa, K.C.S.I.; H. H. The Maharaja of Bhavnagar; H. H. The Maharaja of Travancore; Mr. F. V. Evans, Liverpool; Sir David Ezra, Kt., F.Z.S., Calcutta; Mr. A. S. Vernay, New York and London.

*President.*—H. E. The Right Hon'ble Lord Brabourne, G.C.I.E., M.C.

*Vice-Presidents.*—H. H. The Maharao of Kutch, G.C.S.I., G.C.I.E.; Rev. E. Blatter, S.J., Ph.D., F.L.S.; The Hon'ble Mr. R. D. Bell, C.S.I., C.I.E., I.C.S.

*Executive Committee.*—Right Revd. R. D. Acland, Bishop of Bombay, Mr. Farrokh E. Bharucha, Rev. Fr. J. F. Caius, S.J., Mr. C. B. B. Clee, I.C.S., Mr. Alwyn Ezra, F.R.G.S., F.Z.S., Mr. J. B. Greaves, M.L.C., Prof. V. N. Hate, B.Sc., Mr. J. G. Ridland, Lt.-Col. S. S. Sokhey, I.M.S., Mr. A. Forrington (*Honorary Treasurer*), Mr. P. M. D. Sanderson, F.Z.S. (*Honorary Secretary*), Mr. H. M. McGusty, Bombay.

*Advisory Committee.*—Dr. C. F. C. Beeson, D.Sc., M.A., I.F.S., Dehra Dun. Mr. T. R. Bell, C.I.E., I.F.S. (Retd.), Karwar. Lt.-Col. R. W. Burton, I.A. (Retd.), Coonoor. Mr. C. H. Donald, F.Z.S., Dharmsala. Lt.-Col. F. C. Fraser, I.M.S., Coimbatore. Dr. F. H. Gravely, D.Sc., Madras. Mr. S. F. Hopwood, I.F.S., Rangoon. Mr. C. M. Inglis, M.B.O.U., F.Z.S., Darjeeling. Mr. R. C.

Morris, F.R.G.S., F.Z.S., Coimbatore. Major E. G. Phythian-Adams, F.Z.S., I.A. (Retd.), Nilgiris. Dr. Baini Prashad, D.SC., Calcutta. Mr. H. C. Smith, I.F.S., Burma. Lt.-Col. C. H. Stockley, O.B.E., D.S.O., M.C., Meerut. Mr. J. H. Williams, Coimbatore.

## ANNUAL REPORT OF THE BOMBAY NATURAL HISTORY SOCIETY. FOR THE YEAR ENDING 31st DECEMBER 1933.

### ADMINISTRATION.

*President.*—H. E. the Right Hon'ble Major-General Sir Frederik Sykes, P.C., G.C.I.E., G.B.E., K.C.B., C.M.G.

*Vice-Presidents.*—H. H. The Maharao of Kutch, G.C.S.I., G.C.I.E.; Rev. E. Blatter, S.J.; The Hon'ble Mr. R. D. Bell, C.S.I., C.I.E., I.C.S.

*Executive Committee.*—Right Revd. R. D. Acland, Bishop of Bombay, Mr. H. D. Ash, Mr. Farrokh E. Bharucha, Rev. Fr. J. F. Caius, S.J., Col. Sir Frank Connor, KT., D.S.O., F.R.C.S., I.M.S., Mr. Alwyn Ezra, F.R.G.S., F.Z.S., Mr. J. B. Greaves, M.L.C., Prof. V. N. Hate, B.SC., Mr. J. G. Ridland, Lt.-Col. S. S. Sokhey, I.M.S., Mr. A. Forrington (*Honorary Treasurer*), Mr. P. M. D. Sanderson, F.Z.S., Sir Reginald Spence, KT., M.L.C., F.Z.S. (*Joint Honorary Secretaries*), Bombay.

*Advisory Committee.*—Dr. C. F. C. Beeson, D.SC., M.A., I.F.S., Dehra Dun. Mr. T. R. Bell, C.I.E., I.F.S. (Retd.), Karwar. Mr. C. H. Donald, F.Z.S., Dharmsala. Lt.-Col. F. C. Fraser, I.M.S., Coimbatore. Dr. F. H. Gravely, D.SC., Madras. Mr. S. F. Hopwood, I.F.S., Rangoon. Mr. C. M. Inglis, M.B.O.U., F.Z.S., Darjeeling. Mr. R. C. Morris, F.Z.S., F.R.G.S., Coimbatore. Major E. G. Phythian-Adams, F.Z.S., Mysore. Dr. Baini Prashad, D.SC., Calcutta. Mr. H. C. Smith, Burma. Lt.-Col. C. H. Stockley, O.B.E., D.S.O., M.C., Meerut. Major W. B. Trevenen, Jubbulpore.

*Staff.*—S. H. Prater, M.L.C., J.P., C.M.Z.S. (*Curator*). C. McCann, F.L.S. and V. S. La Personne (*Assistant Curators*).

## THE HONORARY SECRETARY'S REPORT FOR THE YEAR 1933.

### THE SOCIETY'S JOURNAL.

The Thirty-sixth Volume of the *Journal* was completed during the year under review.

*Scientific Papers.—Mammals.*—Mr. R. I. Pocock continued his important papers on Indian Mammals. His papers constitute a revision of the various genera and species based on all records and data available. During the period under review he published a revision of the 'Civet-Cats of Asia' and in Part IV appeared the first part of his paper dealing with 'The Palm Civets or "Toddy-Cats" of the Genera *Paradoxurus* and *Paguma* inhabiting British India.'

In dealing with the Civet-Cats of Asia, Mr. Pocock revised the group *Viverrinae*, which includes the large and small Civets (*Viverra* and *Viverricula* of older authors). His diagnosis is based mainly on the structure of the feet and the cranial characters. In his opinion the genus *Viverra*, as previously understood, embraced animals whose characters are worthy of distinctive generic rank. He accordingly split up the genus into two, retaining the genus *Viverra* to contain the Large Indian Civet (*V. zibetha*) and the Malay Civet (*V. tangalunga*) and placed the Burmese Civet (*V. megaspila*) and the Malabar Civet (*V. civettina*) in a separate genus:—*Moschothera*, created by him. This arrangement is based on the presence or absence of skin-lobes forming claw sheaths on the 3rd and 4th digits. In the genus *Viverra* these particular claw sheaths are present whereas they are absent in the genus *Moschothera*. The author describes five races of *V. zibetha*, four of which occur within Indian limits.

In the second part of this paper the author deals with the Small Indian Civets of the genus *Viverricula*. Mr. Pocock has shown that the old name, *V. malaccensis* of Gmelin, is inadmissible on the ground that the name was misapplied to this species and must therefore give place to the name *indica* of Geoffroy. The author has divided the single species up into 11 geographical races.

Mr. Pocock in a second paper, on the Palm Civets, the first part of which appeared in Part IV of the *Journal*, revises the two genera *Paradoxurus* and *Paguma*. This paper is based mainly on the fine material obtained by the collectors of the Society's Mammal Survey. The author admits only three species as representatives of the genus *Paradoxurus*:—namely the Ceylon Palm Civet, *P. zeylonensis*, the South Indian Palm Civet, *P. jerdoni*, and the Indian Palm Civet, *P. hermaphroditus*. The first named is without any subspecies, the second has been split up into two races, and the last into several races. The paper is in the course of publication.

Mr. C. McCann, the Assistant Curator of the Society, published a paper on the colouration and habits of the White-browed Gibbon or Hoolock. In this paper, the author indicates that there is a complete change of colour in this gibbon from birth to maturity and that this is more evident in the case of the females. Till recently, it was generally accepted that the black and fawn colour was assumed by both sexes, but the author has been able to show that only the females become fawn when they reach maturity and that the males remain black throughout life, after passing through the creamy juvenile phase. The misconceptions which have arisen regarding the colouration of the gibbon are attributed to incorrect sexing of the animals. The length of the peniform clitoris, when superficially examined, has led to the confusing of females with males.

In Part III Mr. McCann published an account of some of the Indian Langurs. The paper is based on material collected by himself and numerous notes made in the field over a period of a number of years. The author is of opinion that there is much variation in the colour in the coat from birth to maturity and that the colouration probably varies also with season and environment. The author also deals with some of the much debated popular beliefs relative to the social life of Langurs and indicates the reasons for some of the errors that have been made.

In Part IV of the volume of the *Journal* under review Mr. McCann contributed a paper on Indian Macaques. He described in detail the little known species *Macaca speciosa*, the Stump-tailed Macaque, from material obtained by him in the Naga Hills, Assam. The paper deals with the colour phases and anatomical changes passed through by these animals from birth to maturity. Mr. McCann is of the opinion that the annulation of the fur may possibly be correlated with the development of the teeth and thereby provide an index of maturity. Along with the article the author has published some good photographs of the adults of this species in the flesh.

*Birds.*—Three further reports (IV-VI) dealing with the collections obtained by the Vernay Survey of the Eastern Ghats, were published by Mr. H. Whistler and Mr. N. B. Kinnear during the period under review. This brings the Survey material now dealt with as far as the Wagtails (*Dendronanthus*).

Three parts dealing with the Hyderabad State Ornithological Survey were published during the year by Mr. S. A. Ali, who is being assisted by Mr. H. Whistler. We published an introductory account of the origin of the Survey in Part II of the *Journal* under review. The Nizam's Dominions, except perhaps for a few stray records, were a closed book to the ornithological world. The report deals not only with the birds met with by the Survey, but also with all known records thus making the results as complete as possible. A study of the published records and the collection made available by the Survey necessitated a revision of some of the hitherto known geographical races.

Mr. Ali who undertook the Survey himself has added much valuable data by way of carefully recorded field notes which have added greatly to the value of the report.

The thanks of the Society are due to Mr. Ali for the painstaking thoroughness with which he conducted the Survey and the careful way he has prepared the report and to the Nizam's Government for their generous assistance.

In Part IV, Dr. Ticehurst contributed a paper on 'Some Birds from Southern Arakan'. This paper is based on a collection made by Mr. Villar while on tour through the Arakan Yomas. The services of the Society's collector, Mr. Henricks was loaned to Mr. Villar. The collection comprised 357 specimens of birds. Dr. Ticehurst is of the opinion that extensive collecting is necessary in Arakan before it can be ascertained what forms occur and any definite conclusion arrived at.

*Fishes.*—In Part III Dr. S. L. Hora published a report on the Fishes of Afghanistan. This report was based on specimens collected by the Military Attache, British Legation, Kabul. The specimens were secured in the Paghman River. With the aid of this collection Dr. Hora was able to amplify some of McClelland's original descriptions. The author considers that Afghanistan is an important area from a zoo-geographical point of view. It forms the boundary line between the Indian element and that of Turkestan. The affinities of the Afghan fish fauna have to be sought further to the north-east. According to the author the Indian element in the fauna does not extend beyond Jalalabad.

In Part IV Mr. Mukerji commenced his report on Burmese Fishes. This report is based on a collection of fish made by Lt-Col. R. W. Burton from the tributary streams of the Mali Hka River in the Myitkyina District. The collection contained 78 specimens comprising 32 species. The author considers that the fish fauna of Burma, beside including endemic species, includes forms which are identical with or related to Indian fishes, particularly those found in the adjacent provinces of Bengal and Assam. There are also to be found forms essentially Chinese or with Indo Australian affinities. The paper is still in the course of publication.

*Insects.*—In Part II Mr. J. A. Yates published a paper on the butterflies of Bangalore and the neighbourhood. His paper is based on a collection made by himself and on the collection and notes of Col. H. C. Winchworth who did much collecting in the area.

In Part III Mr. M. E. Mosley commenced a series on the Caddis Flies, but owing to the late arrival of the MS. the continuity of the series had to be broken. In this paper the author attempts to popularise and encourage the study and collecting of Caddis Flies, by giving a detailed account of their life history and habits. The paper is still in the course of publication.

In Part IV Lt.-Col. F. B. Scott published a paper on the foodplants of Indian Hawkmoths. The author in his paper shows the interrelation that exists between the distribution of hawkmoths and their food plants. The distribution of Hawkmoths and the number of individuals in any locality is intimately connected with their choice of food plants and the distribution of these food plants. The extinction of a certain plant in a particular locality will result in the disappearance of the particular species of moth which feeds on it.

In the same Part, Mr. B. Krishnamurti contributed a paper on the biology and morphology of *Epipyrops eurybrachydis*, a species of moth parasitising *Eurybrachys tomentosa*, one of the members of the aphid group.

During the period under review we published a paper by Col. F. C. Fraser in which he makes additions to the Dragonfly fauna and also describes two new species. He also contributed part xli of his series on Indian Dragonflies. Col. Fraser is now engaged writing the volumes on the Dragonfly fauna of India for the Fauna of British India series, the first volume of which appeared during the period under review.

*Botany.*—During the year we published parts xx, xxi, and xxii of Rev. Father Blatter's Revision of the Flora of the Bombay Presidency. The parts deal with the *Balsaminaceae*, *Rutaceae*, *Asclepiadaceae*, and *Rubiaceae*. The *Asclepiadaceae* and the *Rubiaceae* were written in collaboration with Mr. Mc Cann. They include descriptions of new species and many necessary changes in nomenclature, thereby bringing it up to date in accordance with recent publications.

In Part II of the *Journal* Fr. Blatter published the descriptions of twelve new species of plants from Waziristan. In the subsequent issues Fr. Blatter published the first part of his Flora of Waziristan in collaboration with Mr. J. Fernandez. The material for this flora was collected by the authors when on expedition in the area.

The thanks of the Society are due to Fr. Blatter for his valuable contributions on Indian Botany to the *Journal*. In spite of very indifferent health he has carried on his labours without interruption and we hope that he will be spared to continue and to complete his great work.

*Popular Papers.*—During the year under review we published part xix of vol. v of Mr. Stuart Baker's popular serial on Indian Waders which is now close on completion. We hope that Mr. Stuart Baker will continue to contribute to the Society's *Journal*. He has written for our *Journal* for close on 42 years and has done much to increase its popularity and interest.

Parts xi, xii and xiii, of the serial on Beautiful Indian Trees by Rev. Fr. Blatter and Mr. W. S. Millard were issued during the year. Our thanks are due to the authors for these contributions which add so much to the interest and attraction of the *Journal*.

Mr. W. S. Thom wrote on Some Experiences amongst Elephants and other big game in Burma from 1887-1931. In this interesting article the author narrates his varied experiences and gives sound advice to younger generations of sportsmen.

In the same number (No. 2) Mr. J. C. Higgins commences his article on The Game Birds and Animals of the Manipur State with notes on their number, migration and habits. During the year we published parts 1-3. This paper forms a carefully kept record of all the game shot in Manipur State from 1911-1931.

In Part II of the *Journal*, Mr. S. H. Prater, Curator of the Society, contributed two papers on snakes, one dealing with 'Non-poisonous' Snakes and the other on the Social Life of Snakes. In the first paper the author discusses the use of the term 'non-poisonous' and shows that the majority of snakes are poisonous and equipped with the means of paralysing or killing their prey with their venom. It is not the quality of the poison but the quantity which they inject which controls their power for harming animals which are larger than their accustomed prey. The paper records the investigations carried out by Bertrand, Phisalix and Caius on the toxicity of the venoms of various Silyburine and Colubrine snakes which prove that the venoms which they secrete are sufficiently powerful to kill or paralyse their legitimate prey and that the limited quantity secreted alone prevents them from becoming dangerous to larger animals.

In his second paper Mr. Prater discusses the social life of snakes and the much debated question as to whether a snake traces its mate. He holds that there is much to be said for snakes following on the trail of one another, when driven by sexual impulses. This following is effected by scent. Snakes possess a scent gland near the anus and leave a scent trail behind them whereever they go.

In Part III Dr. Hora published an interesting and valuable paper on the Respiration in Fishes. The article deals with the different means of respiration which have been evolved by fish living under different conditions and assuming different modes of life.

*Economics.*—During the year Mr. Rai published the second and last part of his Report on the Survey of the Shell Fisheries of the West Coast. The author in this part of his paper deals with the *Crustacea*, the Lobsters, Prawns and Crabs, and the methods employed in catching and preserving them for export. He has shown the necessity of safeguarding the industry and is of the opinion that steps should be taken to improve the industry and prevent the catching of breeding and undersized individuals. He suggests that a closed season should be observed after the necessary investigations have been made regarding the breeding habits and local movements.

In 1933 Mr. Sorley published his Report on the Marine Fishes of the Bombay Presidency. While the Report shows a grasp of the economic, sociological and statistical problems underlying the development of fisheries, its attitude towards Scientific Research is less convincing. While the Report admits the need for research and indicates that the author was greatly handicapped because of the absence of data, it recommends that Government, as such, should have nothing to do with research and relegates the work to private bodies but makes no recommendation as regards the co-ordination of research or the financial assistance to private bodies undertaking it.

Government have appointed a Fisheries Officer, but under the present circumstances he cannot possibly have the time to investigate the biological problems which Mr. Sorley in his report admits require immediate investigation. Apart from this, the problems are so vast and cover so many distinct fields of research, that it would require the attention of a number of specialists. Government could make a small beginning by availing themselves of the services of 2 or 3 men who, as a minimum qualification, should have obtained the M.Sc. degree. These men could be paid a small honorarium. They could work under the direction of the Fisheries Officer, who could place practical problems before them for investigation. Hydrographical and Morphological research could be carried out by the teaching staff of the University. The identification of species could be effected through the agency of the Society which is in touch with experts in the Zoological Survey of India and the British Museum.

A study of the habits, food, growth, parasites and enemies of fishes could best be investigated by the establishment of a Marine Aquarium. Every one who has studied the question will agree with Mr. Sorley when he says that a Marine Aquarium if established in Bombay will be self supporting. Complete plans for an Aquarium in Bombay were made by the Society but the scheme is held in abeyance for want of money. If an Aquarium could be built in Bombay no special staff would be required for managing it as this could be done by the officials of the Society. Research work in the aquarium could be effected through the Fisheries Officer and his scientific assistants. Apart from its recreational and educational value the Aquarium would become a factor in the development of local fisheries. Finally Government should establish a Board of Fisheries on which representatives of the Society and other scientific institutions should find a place, together with such other interests as government might like to consult. Among others we would recommend a representative of the Zoological Survey of India and of the Madras Fisheries department. There is need for co-operation between Fishery experts of various provinces.

*Preservation of the Fauna.*—During the period under review the first part of the series dealing with the Preservation of the Fauna of this country appeared in Part IV of the *Journal*, as a separate supplement. A foreword to the series was written by H. E. the Viceroy. The Introduction gives a broad outline of the various problems underlying the question of wild life protection in this country and indicates the need for a concerted policy and concerted action on the part of the State. It is followed by a short sketch of the geographical features of the country and the animal life inhabiting it. It stresses the necessity for giving the matter sufficient publicity and awakening the interest of the public. This is followed by descriptions of the animals together with coloured and black and white illustrations. The thanks of the Society are due to Mr. F. V. Evans of Liverpool who has very generously paid for the illustrations and to Their Highnesses the Maharaja of Chamba State, Jodhpur, Travancore, Bhavnagar, Rajgarh and Junagadh who have generously contributed to the cost of printing these articles. Various authors have contributed their views to the present position of game in their particular districts and suggested measures that should be adopted for the protection of the fauna in their localities. Mr. Dunbar Brander deals with the Central Provinces and Mr. G. Monteath with the Bombay Presidency.

*Miscellaneous Notes.*—The Miscellaneous Notes which comprise the observations of numerous individuals add greatly to the interest of the *Journal.* Our thanks are due to all the authors of the various papers who have contributed so much to make the *Journal* a success.

*Expeditions and Explorations.*—The Society was able during the year to undertake an Ornithological Survey of the Jodhpur State. Mr. V. S. La Personne conducted the Survey. Our grateful thanks are due to His Highness the Maharaja of Jodhpur for a grant of Rs. 3,500 made by him towards the cost of the expedition and to his officers for the assistance they gave to the expedition.

*Expenditure and Receipts.*—The total anticipated income of the Society for the year 1933 was Rs. 38,024-15-9. Actual receipts amounted to Rs. 39,948-9-4 as compared with Rs. 36,399-8-5 during 1932, shewing an increase of Rs. 3,549-0-11.

The increase in revenue is mainly due to receipts under the following heads:—

| | 1932<br>Rs. | 1933<br>Rs. |
|---|---|---|
| Life Membership ... ... | 700 | 1,950 |
| Entrance Fees ... ... | 678 | 1,070 |
| Savings in Jodhpur Survey . ... | ... | 600 |

All other receipts are within estimated income.

The following figures show comparatively the number of members on the roll of the Society (excluding Life Members) on the 1st of January 1933 and 1934 and the number who paid their subscription during the year:—

| | No. of Members on Roll | No. of Members who paid subscription |
|---|---|---|
| 1933, 1st. January ... ... | 963 | 893 |
| 1934, 1st. January ... ... | 979 | 888 |

During the year 1933 the Society has lost 91 members from resignations, while new members for this period amount to 107.

1933 was the Jubilee year of the Society in which it completed 50 years of continuous progress. To enable it to continue its work the Society requires the generous support of its members. This help they can give most effectively by continuing their membership and inducing their friends to join. We would greatly appreciate the active co-operation of members at the present time.

A Special Meeting to commemorate the Fiftieth Anniversay of the Society was held at the Cowasjee Jehangir Hall on the 10th August 1933 at 9-45 p.m. Sir Hugh Cocke, the Sheriff of Bombay, was in the chair. His Excellency the Viceroy was unfortunately unable to be present, but a special message was received from His Excellency the Governor of Bombay, the President of the Society, congratulating the Society on the great work it had accomplished during the 50 years of its existence and wishing it all success in the future.

Mr. P. M. D. Sanderson, Honorary Secretary, gave a brief History of the Progress and Development of the Society. He was followed by Mr. S. H. Prater, the Society's Curator, the subject of whose address was the 'Problem of Wild Life Protection in India'. The text of Mr. Prater's address on Wild Life Protection appeared in the Supplement to volume xxxvi, No. 4.

The text of Mr. Sanderson's speech is not published as it is proposed to issue shortly a special Jubilee Number of the *Journal* which will give an account of the origin and growth of the Society and provide a record of its various activities during the last 50 years of its existence.

The thanks of the Committee and Members of the Society are due to Mr. A. S. Vernay who has given the Society a special donation to meet the cost of printing this Special Number.

*Sir Reginald Spence.*—The Committee wished to place on record their thanks and appreciation of Sir Reginald Spence's services to the Society as Honorary Secretary and Editor of its *Journal.* The progress the Society has made during the past 10 years was largely due to his able management of its affairs. His departure from India is a great loss and it is hoped that he will continue his interest in the Society and that we shall continue to receive the benefit of his help, and encouragement.

*Staff.*—The Committee take this opportunity of placing on record their appreciation of the services of the Curator and his staff whose labours have enabled it to continue and maintain the standard of its work under the difficult conditions which prevail at present.

P. M. D. SANDERSON,
*Honorary Secretary.*

12*th March*, 1934.

# BOMBAY NATURAL HISTORY SOCIETY.

## *BALANCE SHEET AS AT 31st DECEMBER 1933.*

| LIABILITIES | Rs A P | Rs A P |
|---|---|---|
| *Life Membership Fees as per last Balance Sheet.* | …… | 47,150 0 0 |
| *Donations for specific objects unexpended:* | | |
| Show Cases, etc. in existing building … | 2,133 11 4 | |
| Show Cases in new building … … | 17,147 2 4 | |
| Jubilee Number Fund … … … | 1,500 0 0 | |
| Journal Fund … … … … | 7,533 7 0 | |
| Jodhpur Survey … … … … | 616 7 3 | 28,930 11 11 |
| *Sundry Creditors:* | | |
| Printers of Journals … … … | 3,584 6 9 | |
| ,, ,, Game Books, Vol. III … | 889 7 1 | |
| For Expenses … … … … | 250 0 0 | 4,723 13 10 |
| *Surplus Assets—* | | |
| Balance as per last Balance Sheet … | 37,522 15 2 | |
| *Less*—Loss on Revenue Account … Rs. A. P. 2,452 8 9 | | |
| Fluctuation in the value of 3½% G. P. Notes of Rs. 10,000 purchasd in 1933 … 318 12 0 | | |
| *Add:* Surplus on Publication Account … | 2,771 4 9 | |
| | 34,751 10 5 | |
| | 104 11 6 | 34,856 5 11 |
| Total … | | 1,15,660 15 8 |

| ASSETS | Rs A P | Rs A P |
|---|---|---|
| *Investments as per last Balance Sheet or market value on 31st December 1933, whichever is lower:* | | |
| Rs. 28,000 Govt. 3½% Pro. Notes at Rs. 74-9/16%… | 20,877 8 0 | |
| ,, 10,000 ,, do. do. 82-11/16%. | 8,268 12 0 | |
| ,, 15,000 ,, 5% 1945-55 To an at par. | 15,000 0 0 | |
| ,, 8,000 ,, 6½% Dev. Loan … | 8,000 0 0 | |
| ,, 14,000 Port Trust 4% Bonds at 77% … | 10,780 0 0 | |
| ,, 15,000 Imp. ,, 4% ,, at 76% … | 11,400 0 0 | 74,326 4 0 |
| *Investments on account of Building Fund:* | | |
| Rs. 10,300 Govt. 4% Last 1934-37 at par. … | 10,300 0 0 | |
| ,, 5,700 ,, 5½% ,, 1938-40 ,, … | 5,700 0 0 | |
| ,, 500 ,, 5 % ,, 1945-55 ,, … | 500 0 0 | 16,500 0 0 |
| *Cash—* | | |
| With National Bank of India Ltd., Bombay … … … … | 11,466 14 3 | |
| With National Bank of India Ltd., London … … … … | 257 3 7 | |
| On hand … … … … … | 150 0 0 | 11,874 1 10 |
| *Sundry Debtors* … … … … | … | 714 13 0 |
| *Furniture* … … … … | 1,727 0 0 | |
| *Less* Depreciation … … … … | 50 0 0 | 1,677 0 0 |
| *Publications, excluding Journals:* | | |
| As certified by the Secretary … … | … | 300 0 0 |
| *Game Books,* Vol. III: Stock on hand as certified by the Secretary … … | … | 1,098 3 8 |
| *Bird Charts,* Stock on hand as certified by the Secretary … … … … | … | 5,962 9 7 |
| *Bates' Bird Life:* | | |
| Stock on hand as certified by the Secretary … … … … … | … | 1,197 6 6 |
| *Butterfly Books:* | | |
| Stock on hand as certified by the Secretary … … … … | … | 496 2 10 |
| *Beautiful Indian Trees:* | | |
| Stock on hand as certified by the Secretary … … … … | … | 1,514 6 3 |
| Total … | | 1,15,660 15 8 |

*Note.*—A stock of 21,535 old Journals and the Valuable Research Collection and Library of 2,550 volumes have not been taken into account on the Asset side of the Balance Sheet.

We have prepared the above Balance Sheet from the cash book and from information given to us, and have verified the investments.

In our opinion, such Balance Sheet represents a true and correct view of the state of the Society's affairs according to the best of our information and explanations given to us.

BOMBAY, *17th February, 1933.*

(Sd.) A. F. FERGUSON & CO.,
*Chartered Accountants, Auditors.*

(Sd.) A. FORRINGTON,
*Honorary Treasurer,*

# BOMBAY NATURAL HISTORY SOCIETY.

## *REVENUE ACCOUNT FOR THE YEAR ENDED 31st DECEMBER 1933.*

| | Rs A P | Rs A P | | Rs A P | Rs A P |
|---|---|---|---|---|---|
| To Salaries ... ... ... ... ... | 19,060 9 0 | | By Life Membership Fees... ... ... | 1,950 0 0 | |
| ,, Society's Contribution to Provident Fund | 1,539 3 0 | | ,, Subscriptions ... ... ... ... | 23,467 0 6 | |
| ,, General charges ... ... ... | 568 2 7 | | ,, Entrance Fees ... ... ... ... | 1,070 0 0 | |
| ,, Rent ... ... ... ... | 2,436 0 0 | | ,, Sales of Journals ... ... ... | 2,093 14 7 | |
| ,, Stationery and Printing ... ... ... | 365 5 0 | | ,, Interest on Investments ... ... ... | 3,507 13 11 | |
| ,, Postage ... ... ... ... | 1,110 10 0 | | ,, Taxidermy Department ... ... ... | 473 2 9 | |
| ,, Library ... ... ... ... ... | 411 5 4 | | ,, Profit on Sale of Investments ... ... | 150 0 0 | |
| ,, Audit Fee ... ... ... ... | 250 0 0 | | ,, Bird Mounting ... ... ... ... | 500 0 0 | |
| ,, Insurance ... ... ... ... | 100 0 0 | | ,, Sales of Games Book, Vols. I & II ... | 822 5 4 | 34,034 5 1 |
| ,, Furniture Depreciation ... ... ... | 50 0 0 | | ,, Loss ... ... ... ... ... | 2,452 8 9 | |
| ,, Cost of Printing Journals ... ... | 10,595 10 11 | 36,486 13 10 | | | |
| Total ... | | 36,486 13 10 | Total ... | | 36,486 13 10 |

## *PUBLICATION ACCOUNT FOR THE YEAR ENDED 31st DECEMBER 1933*

| | Rs A P | Rs A P | | Rs A P | Rs A P |
|---|---|---|---|---|---|
| To Cost of Printing Fish Pamphlets ... | 64 0 0 | | By Snake Charts ... ... ... ... | 85 0 0 | |
| | | | Society's Publications ... ... ... | 57 3 6 | |
| ,, Balance carried to Surplus Assets ... | 104 11 6 | | ,, Fish Pamphlets ... ... ... ... | 26 8 0 | |
| | | 168 11 6 | | | 168 11 6 |
| ,, Stock of Bird Charts and Albums ... | ......... | 7,819 14 8 | ,, Sales of Bird Charts and Album ... | 1,857 5 1 | 7,819 14 8 |
| | | | ,, Stock on hand ... ... ... ... | 5,962 9 7 | |
| ,, Stock of Game Book, Vol. III ... ... | 1,466 0 8 | 1,466 0 8 | ,, Sales of Game Books, Vol. III ... ... | 367 13 0 | 1,466 0 8 |
| | | | ,, Stock on hand ... ... ... ... | 1,098 3 8 | |
| ,, Stock of Bates' Bird Life ... ... | ......... | 1,295 0 6 | ,, Sales of Bates' Bird Life ... ... | 97 10 0 | 1,295 0 6 |
| | | | ,, Stock on hand ... ... ... ... | 197 6 6 | |
| ,, Stock of Butterfly Books... ... ... | ......... | 781 2 10 | ,, Sales of Butterfly Book ... ... ... | 285 0 0 | 781 2 10 |
| | | | ,, Stock on hand ... ... ... ... | 496 2 10 | |

# BOMBAY NATURAL HISTORY SOCIETY.

## *INCOME AND EXPENDITURE ACCOUNT OF DONATIONS FOR SPECIFIC PURPOSES FOR THE YEAR ENDED 31st DECEMBER, 1933.*

| | *Rs a p* | *Rs a p* | | *Rs a p* | *Rs a p* |
|---|---|---|---|---|---|
| To Expenditure on Show Cases, etc. ... | | 4,144 7 6 | By Unexpended Balance for Show Cases, as per last Balance Sheet ... ... | 2,253 2 10 | |
| ,, Balance carried to Balance Sheet ... | | 2,133 11 4 | ,, Donations for Modeller's Salary etc. ... | 4,025 0 0 | 6,278 2 10 |
| | | 6,278 2 10 | | | 6,278 2 10 |
| ,, Premium paid on purchase of 4% 1934-37 Loan ... ... ... ... | 152 4 0 | | ,, Unexpended balance for Show Cases in New Building as per last Balance Sheet ... ... ... ... ... | 16,313 11 3 | |
| ,, Balance carried to Balance Sheet ... | 17,147 2 4 | 17,299 6 4 | ,, Profit on Sale Proceeds of the Terminal Loan ... ... ... ... ... | 292 12 0 | |
| | | | ,, Interest on Investments ... ... | 692 15 1 | 17,299 6 4 |
| ,, Carried to Balance Sheet ... ... | | 1,500 0 0 | ,, Jubilee Fund ... ... ... ... | | 1,500 0 0 |
| ,, Expenses in Printing Plates, etc. ... | 721 15 0 | | | | |
| ,, Balance Carried to Balance Sheet ... | 7,533 7 0 | 8,255 6 0 | ,, Special Journal Fund ... ... ... | | 8,255 6 0 |
| ,, Expenses in Jodhpur Survey ... ... | 2,887 10 9 | | | | |
| ,, Balance Carried to Balance Sheet ... | 616 7 3 | 3,504 2 0 | ,, Jodhpur Survey... ... ... ... | | 3,504 2 0 |

BOMBAY, *17th March, 1934.*

3

Examined and found correct.
(Sd.) A. F. FERGUSON & CO.
*Chartered Accountants, Auditors.*

A. FORRINGTON,
*Honorary Treasurer.*

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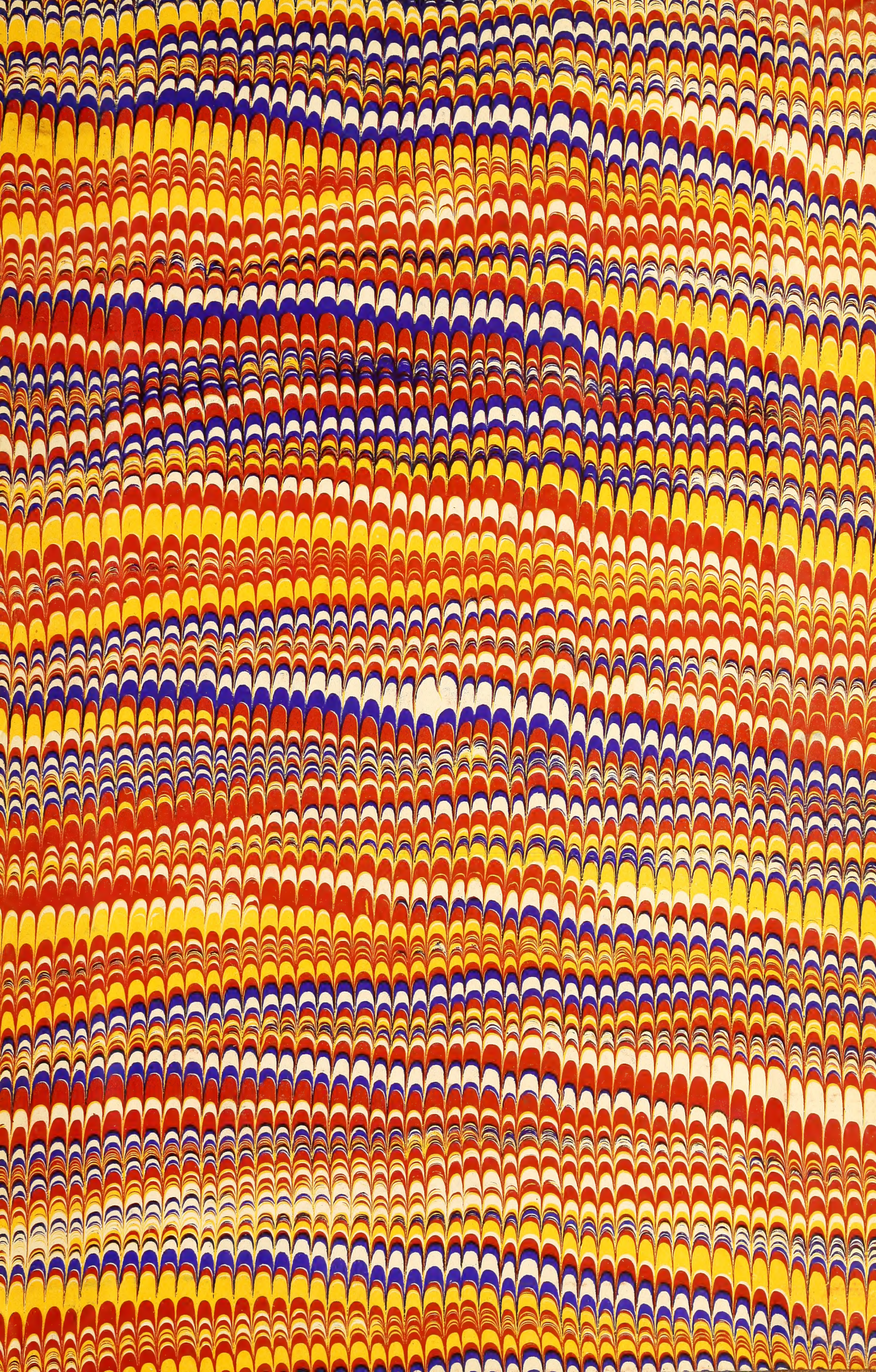

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